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ABSTRACT

To determine competencies needed by employees in the seed production and distribution industry, a questionnaire containing 49 competencies was compiled with the assistance of specialists and mailed to 100 company managers and 200 nonmanagerial employees. Returns from the 200 usable questionnaires indicate that the competencies needed most by managers and sales personnel were the abilities to make sound decisions, delegate responsibilities, communicate effectively, work cooperatively, and use quality control measures to maintain quality seed. The competencies needed most by production and processing personnel wer e the abilities to apply and handle safely agricultural chemicals and to work cooperatively, and the understandings of: (1) seed viability, purity, and germination, (2) crop maturity and planting dates, and (3) soil sampling and fertilizer recommendations. The results indicate, however, that all 49 competencies are needed to some degree for successful seed production and distribution. This M.S. thesis was submitted to Iowa State University. (GB)

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COMPETENCIES NEEDED BY SEED PRODUCTION AND DISTRIBUTION COMPANY EMPLOYEES

by

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INTRODUCTION

Production of agricultural seed in Iowa and the nation is a large volume industry measured either by the acreage and production or by the value of production. According to the United States Deparment of Agriculture Statistical Reporting Service Data (17), production of 17 kinds of seeds for hay, pasture, turf, and winter cover, was estimated at 514 million pounds for 1968 and valued at $96,594,000.00 for the United States. The two major seeds for pastures in Iowa are red clover and timothy with a production in 1968 of 4,430,000 pounds with a value of $1,052,000.00.

The May, 1969, Field and Seed Crops published by the U.S.D.A. Crop Reporting Board showed how corn and soybean seed dominates the seed industry in Iowa. In Iowa there were 177,952,000 bushels of soybeans produced with a value of $435,982,000.00 assuming soybeans worth $2.45 per bushel. The total number of bushels of beans for seed was 6,758,000.

Iowa produced 901,728,000 bushels of corn for grain in 1968 with a value of $937,797,000.00 assuming corn worth $1.04 per bushel from 9,696,000 acres.

According to R. H. Sutherland, Iowa Crop and Livestock Reporting Service statistician, in private communication July 24, 1968, one can estimate the bushels of feed grain used for seed by applying average planting rates per acre to acres planted.

Assuming four acres of corn per bushel of seed corn, calculations show that to plant 9,696,000 acres of corn in Iowa it requires 2,424,000 bushels of seed corn. Assuming further that each bushel of seed corn retailed at $20.00 per bushel, calculations show that seed corn retail value in Iowa was a 48 million dollar business.

The importance of seed corn, soybean seed, grass and legume seed, small grain seed, plus vegetable and flower seeds in Iowa indicate the need of a study of the competencies needed by individuals employed in this industry. Competencies necessary for efficient seed production, processing and sales need to be defined and evaluated as to validity and reliability of each in planning training programs for present and prospective employees in the seed industry.

This investigation, dealing with competencies needed by employees of that seed industry, is one of a series of studies in Research Project 1733, being conducted jointly by the Department of Agricultural Education and the Iowa Agriculture and Home Economics Experiment Station of Iowa State University and the Agricultural Education Section of the Division of Vocational Education, State Department of Public Instruction.

The study was conducted by the author in cooperation with the Iowa Seed Dealers Association, Des Moines, Iowa, and Iowa Crop Improvement Association, Ames, Iowa.

The main objective of this study was to determine the competencies needed by employees in the seed production and distribution industry.

The specific objectives were: (1) to determine the degree of competence employees of the seed industry needed and possessed in each competency and (2) to determine the relationships between the competencies and the characteristics of (1) the seed industry, and (2) the employees of the seed industry.

REVIEW OF LITERATURE

Only recently has work been done on the identification of competencies in agricultural occupations, however, professional groups within the seed industry have requested that attention be directed toward identifying competencies. According to the ninth resolution adopted at the 64th annual convention of the Iowa Seed Dealers Association (14), Iowa State University was urged to review its agricultural curriculum so that it may prove more useful in meeting the needs of the industry in the areas of salesmanship, marketing and technology.

Clark (9) conducted a study to determine the competencies needed to prepare workers for employment or advancement in agricultural occupations. A survey of agricultural businesses was conducted by asking managers and workers to respond to a checklist indicating the kinds of activities they performed. Some of the conclusions from Clark's studies (9, p. 9) were:

1. Sales, office, and service activities were rated as functions of the industry being studied.
2. New kinds of programs need to be developed to meet needs of various industries.
3. Some training programs may be offered in high school and others may be offered in a post-high school program.
4. Each kind of agricultural business should be analyzed for functions performed, and competencies needed, to provide a satisfactory basis for organizing a training program.

A summary has been made of the findings of predominantly interview-type surveys of employment needs in off-farm agricultural businesses in 26 states. The summary was compiled by Robert E. Taylor (16), Director of the Center for Research and Leadership Development in Vocational and Technical Education at Ohio State University. Some generalizations that may be drawn from the findings are:

1. Almost half the people employed in off-farm agricultural businesses need education or training in agriculture.
2. Employers expect about a twenty per cent increase in the number of employees needing agricultural competencies in the next five years. This parallels the anticipated expansion in the total labor force.
3. Need for greatest numbers or agriculturally-trained employees will be in agricultural supplies sales and services, agricultural machinery sales and services, ornamental horticulture, and marketing and distribution of livestock and food crop products.
4. Agricultural competencies needed are closely identified with the products handled by the business.
5. Many of the agricultural subjects taught to students preparing for production farming will be needed by students who enter off-farm agricultural occupations.
6. There are many instances in which vocational agriculture may support, or be supported by, other vocational subjects taught.
7. Salesmanship, human relations, and business management are competencies needed by all employees, but in varying degrees.
8. Vocational-technical education programs beyond the twelfth grade are appropriate for many persons.
9. Trainees with a farm background or farm experience have a definite advantage when seeking employment in off-farm agricultural businesses.

In another study (5) C. E. Bundy and D. L. Blake summarized the findings of selected occupational areas of off-farm occupations in agriculture in Iowa. Some of the main points that may be drawn from the summary (5, p. 46) are:

1. The degree of competence needed among the occupational areas within the off-farm agricultural occupation industries varied according to the type of understanding, ability, and occupation level.

2. The agricultural competencies needed by sales and managerial employees were similar, but different from those of clerical or service employees.

3. Employer evaluations of employees and employee self-evaluations revealed that a greater degree of competence was needed in agriculture than employees possessed.

4. The smaller the business, the more competent employees needed to be in a greater number of knowledges and skills.

5. As years of farm background increased, the degree of competence needed and possessed by employees increased.

6. In the main, as years of vocational agriculture background increased, the degree of competence needed and possessed by employees increased.

7. As size of business increased, the degree of competence needed and possessed increased in competencies characteristic of a level of employment.

William W. Stevenson (15), summarized the findings of over 700 personal interviews with owners or managers of several types of businesses serving farmers' needs or processing and distributing farm products in Oklahoma. Stevenson (p. iii) drew the following generalizations:

1. The greatest number of employees is found in the service (skilled and semi-skilled) phase of the businesses.

2. The greatest increase in number of employees with agricultural training is expected in the ornamental horticulture, agricultural machinery, and agricultural supplies businesses.

3. Competence in human relations and salesmanship are generally needed by all employees, but in varying degrees.

4. Agricultural competencies needed are largely determined by type of business and product handled.

5. Approximately fifty percent of the employees in off-farm agricultural businesses need education beyond the high school level while for the other half a high school education is sufficient.

6. Managers interviewed indicated that in 82 percent of the cases they would prefer employees with a farm or rural back-

ground. The remaining 18 percent had no preference as to background.

7. The annual need for professional college trained agricultural workers in the business and in service agencies interviewed was estimated to be about 400 per year.

Referring to agricultural industries and training programs, Christensen and Clark (6, p. 9) of Michigan State University stated the following general conclusions from their study:

1. Analyzing a total industry in terms of the functions performed, the competencies needed to perform these functions, and the understandings, abilities and skills supporting the competencies for proper performance of these functions is a satisfactory method for arriving at subject matter content for training present and prospective workers for non-farm agricultural business and industry.

2. Training programs can be developed to prepare workers for employment in the agricultural-chemical industry at whatever level is needed.

3. The foundation for the training program will be the competencies with their accompanying understandings, abilities, and skills.

They also determined the functions performed within the agricultural-chemical industry. They (6, p. 7) defined function as "something that is done at one or more points in the total industry and that is essential for the successful operation and performance of the industry."

The following nine functions were identified: (1) research, (2) transportation, (3) processing, (4) public relations, (5) sales, (6) service, (7) office records and management, (8) maintenance, (9) purchasing.

Johnson (12) studied competencies in corn production needed by farmers. A 12 member panel of specialists in corn production and management developed a list of 49 competencies consisting of 23 understandings and 26 abilities. The competencies were submitted to a sample of 180 master corn growers and 360 random farmers in Iowa to evaluate the degree of competence they needed and possessed for each competency.

The ten competencies which had the widest differences between competence needed and possessed scores for both groups of farmers were understandings of (1) the future market; (2) the role of trace elements; (3) the hybrid variety differences in resistance to disease and insects; (4) the effect of stress on corn growth at different stages of development; (5) the role on NPK; and the abilities to (1) recognize disease symptoms; (2) identify insects; (3) recognize major plant food deficiency symptoms; (4) evaluate merit of new technology; and (5) select proper chemicals for insect control.

Product moment correlation matrices were run for the two groups of corn growers with eight significant correlations found between the six control items for the master corn growers. The highest correlation was between years of farm experience, and the ability needed to select proper chemicals for insect control (+.27). Correlations between control factors and competence possessed scores resulted in three correlations significant at the five percent level. All three involved vocational agriculture with the highest correlation being the number of years of vocational agriculture and the understanding possessed of the role of NPK (+.19).

Both groups of farmers had higher overall competence needed than competence possessed scores. The master corn growers had slightly higher scores than the random sample farmers for both competence needed and possessed. Johnson commented on this in his discussion (12, p. 59):

> The results of this study indicate all 49 competencies are needed for successful corn production. Both master corn growers and random sample farmers rated their competence possessed much lower

than competence needed. These competencies should provide the foundation for instructional programs related to corn production and management in high school vocational agriculture classes, adult and young farmer classes, area vocational-technical programs, and land grant college courses in corn production.

A study of competencies in soybean production needed by farmers was made by Hoskey (11). A ten-member panel consisting of four outstanding soybean producers and six soybean specialists formulated a list of 24 understandings and 28 abilities. The competencies were submitted in questionnaire form to 147 Master Soybean Growers and adult farmer class members throughout Iowa. The respondents were asked to rate the degree of competence they needed and possessed.

The five most needed understandings and abilities, based on the competence needed mean scores of the master growers, were the understandings of (1) the role of cultivation and herbicides in weed control, (2) the effect of depth of planting on emergence and yield, (3) the importance of timing in all operations, (4) the effect of herbicide carryover, and (5) the importance of a seed test for germination; and the abilities to (1) adjust machinery properly to minimize harvest damage and loss, (2) evaluate and select proper varieties, as related to yield, lodging, maturity, insects, and disease resistance, (3) calibrate spray equipment, (4) safely handle insecticides, and (5) choose most profitable method of marketing soybeans.

The master growers felt much competence was needed for the understandings of (1) conservation practices needed to control water runoff and soil loss, (2) the role of lime in soybean production, (3) choosing the proper N, P, and K ratio, (4) the influence of tillage and weather factors on yields, (5) the effect of row and plant spacing on lodging, yield, etc., (6) the effect of stress on soybean growth at different states of development, (7) the precautions necessary in handling and storing soybean chemicals, (8) the effect of herbicide drift from other crops, (9) the effect of weather on herbicide and insecticide performance, and (10) the role of inoculants in soybean production. Abilities with mean scores of 3.0 or above for competence needed were (1) inoculate soybeans properly, (2) establish a realistic yield and cost goal, (3) determine soil types and how to manage them, (4) take a soil test, (5) interpret soil test results, (6) recognize nutrient deficiency symptoms, (7) determine when and how to prepare a good seedbed, (8) set tillage equipment (plow, disc, cultivator), (9) calibrate the planter for soybeans, (10) identify major soybean insects and select chemicals for their control, (11) determine when damage warrants the use of chemicals, (12) recognize disease symptoms, (13) identify weeds and select chemicals to control them, (14) evaluate merit of new technology in soybean production, and (15) keep and analyze enterprise records.

Hoskey (11) noted that when mean scores were compared with several variables the following relationships were found: (1) competence needed and possessed scores increased with increasing age, except for the competence needed in understandings by the adult farmers, which decreased with age; (2) competence needed and possessed scores increased with increased years of vocational agriculture completed; (3) scores increased as the amount of post-high school training in soybean production increased; (4) with the exception of six master growers with less than a high school education, as years of formal education completed by both groups increased, the competence needed and possessed scores also increased; (5) the master growers and adult farmers who were owners or partial owners had the highest scores; (6) maximum years of farming experience resulted in highest competence needed and possessed scores for both groups.

Hoskey summarized the need for training as follows (11, p. 80):

> The findings of this study indicate a need for training in all 52 competencies necessary for success in soybean production. Some competencies need more emphasis than others. The respondents in both groups of farmers felt they possessed considerably less competence in soybean production than they needed. These 52 competencies should form the basis for instruction in soybean production in vocational agriculture classes for high school boys, young and adult farmers, in the cooperative agriculture extension program, in area vocational-technical schools, and in the College of Agriculture resident instruction program.

Mabon (13) interviewed elevator managers to determine the competencies needed and possessed by their employees. The conclusion was reached that farm experience and high school vocational agriculture can provide the foundation for this area of off-farm agricultural occupations. On-the-job training could be provided during the junior or senior years. For more specialized training, short courses, or degree courses may be needed, and the development of area vocational-technical could be a source of aid for many students to receive initial or advanced schooling.

Competencies which are related to the seed industry were identified and ranked by Mabon (13). He found the 10 highest ranked competencies needed by males employed in country elevator grain marketing to be : (1) understanding of moisture and grade limits for storage, (2) sample, weigh and grade grain, (3) operation of grain moisture testers, (4) use, effects, and safe use of fumigants, (5) Federal Drug Administration regulations regarding grain sanitation, (6) read and interpret grain temperature tests, (7) aerate and condition grain, (8) identify insects, pests and fungi controls, (9) blend grain, and (10) make recommendations to farmers regarding proper use of crop fertilizers and chemicals.

In a study of the competencies needed in the retail feed business at Iowa State University, Hamilton (10) found that of 41 important competencies identified, 25 were in crop or livestock production and farm management. The other 16 competencies dealt with phases of business and dealership management.

He determined that the 10 most important competencies were: (1) to analyze a farmers credit potential, (2) recognize potentially good customers, (3) adjust formulations to individual nutritional requirements, (4) communicate with farmers regardless of their education or experience on feeds and feeding problems or programs, (5) select the items to fit the customer's operation, (6) feed or sanitation products, (7) see weaknesses in customer's operations and make suggestions that are acceptable to the customer to improve his management ability, (8) show honest concern over customers not following proper feeding programs, (9) accurately compute formulations for customers with various lots of grain delivered for processing, and (10) the understandings of the nutritive elements such as protein, fat and fiber, and animal nutrition, health and sanitation.

Hamilton found that of the ten most important competencies needed by males employed in the retail feed business, equal emphasis was being placed on agriculture and business or dealership operations.

In another study, Van Loh (21), found several significant facts in regard to the competencies needed by 120 fertilizer retailers. He found the ten most needed competencies to be: (1) amounts of fertilizer required for various levels of crop production, (2) seed quality and plant population relative to fertilizer response, (3) weed and insect problems and their control, (4) interpreting a soil test report, (5) identifying fertilizer materials and evaluating formulas, (6) making proper recommendations regarding fertilizer use and help individual customer keep a fertilization history on his farm, (7) recognize good, new fertilizer practices and recommending their use, (8) recognizing plant food deficiency in growing crops, (9) making recommendation in absence of a soil test report, and (10) determining an individual's financial situation and management level.

He found a high correlation between vocational-agriculture training and competence needed and possessed in the following: (1) understanding of fertilizer required for various levels of crop production, (2) seed quality and plant population in relation to fertilizer response, (3) and possessed competence in the understanding of weed and insect control.

Abel (1) found that the six top competencies in order of their rank according to competence possessed by outstanding farmers were: (1) ability to recognize the stage of maturity at which to harvest high quality forage; (2) ability to use machinery efficiently to minimize harvest time; (3) ability to select high quality seed; (4) understanding of effect of different amounts and quality of forage feeding on livestock performance and costs; (5) understanding of effects of seedbed, seeding rate and depth on stand and yield; and (6) ability to determine the moisture content at which to begin final machine harvest operation for best storage preservation.

The seven competencies requiring the greatest knowledge and skill, based on the competence needed mean scores for the group of outstanding farmers were: (1) determine levels of feeding forage, grain and supplement to formulate least time and least cost balanced rations; (2) determine the moisture content at which to begin final machine harvest operation for best storage preservation; (3) calibrate planting, fertilizing and spraying equipment; (4) recognize the stage of maturity at which to harvest high quality forage; (5) evaluate quality for forage being fed; (6) recognize major plant food deficiency symptoms in growing forages; and (7) the understanding of effects of various insecticides and herbicides on forage chemical residue limitations or restriction.

The competencies in soil management and fertilizer use needed by farmers were studied by Bennett (4). A 15 member panel of specialists in soil management and fertilizer use developed a list of 46 competencies consisting of 22 competencies needed in the use of fertilizers and 24 competencies needed in soil management. The competencies were submitted to 314 farmers who had been named as outstanding farmers within their communities by the Junior Chamber of Commerce.

Forty-four of the 46 competencies had higher mean scores for degree of competence needed than for degree of competence possessed. Bennett commented on this fact in his discussion as follows (4, p. 67):

> The fact that 200 outstanding farmers felt they needed more competence than they presently possess in 44 of the total 46 competencies gives an indication of importance they placed upon a farmer being competent in the abilities and understandings.

The five highest ranking needed competencies were the understandings of: (1) the responsibility for maintenance of soil productiveness for future generations; (2) the control of weeds and soil insects; (3) the development of a farm plan for maximum use of resources; (4) the economic principles in soil management; and (5) the balanced nutritional needs of crops.

Based upon the results of statistical treatment of the data, Bennett stated in his discussion that (4, pp. 67-68):

> All ten high ranking needed competencies were significantly correlated at scores above the one percent level, when compared with

> each other. The high correlations of the competencies also indicated that while each competency was important, the 200 outstanding farmers had apparently placed an equally high rating on all of the top competencies. This indicates that the understandings and abilities of a few high scoring competencies are not enough; all are important to the successful farmer.

Beaver (3) studied competencies in farm labor utilization needed by farmers. A ten-member panel developed a list of 49 competencies consisting of 14 understandings and 35 abilities which were included in a questionnaire. The questionnaires were mailed to 399 randomly selected farmers and 250 farmers recommended by 50 vocational agriculture instructors as being top managers of farm labor.

Both selected and random sample groups of farmers had degree of competence needed mean scores of 3.0 or higher for the understandings of: (1) the importance of timeliness of operation in crop and livestock production, and (2) when farm operator time is more profitably utilized in management activities than as labor.

Other understandings with high competence needed mean scores for both groups were the understandings of (1) returns and costs of using additional labor in each farm enterprise, and (2) the size or volume of farm business necessary to employ full-time the year-around labor available on the farm.

Beaver concluded in his summary as follows (3, p. 111):

> At least 49 competencies were considered necessary for efficient utilization of farm labor. The competencies should serve as the basis for farm labor management instruction in agricultural education programs for vocational agriculture high school students, young and adult farmers, and in curricula in farm production and management in the area vocational schools and the College of Agriculture.

Christy (7) identified 40 competencies in farm business analysis needed by farmers. A 16-member panel composed of seven progressive farmers, and nine bankers, Iowa State University staff members, farm business association fieldmen, and professional farm managers compiled the 40 competencies which were rated by 142 members of the Central Iowa Farm Business Association and 110 random sample farmers as to degree each was needed and competence possessed. Both groups represented the same 15 north central Iowa counties.

In his discussion, Christy (7, p. 101) states, "The author assumed that a difference between degree needed and possessed scores would indicate the most important possibilities for educational programs."

Several of the competencies having a difference in mean scores of 0.7 or greater between competence needed and possessed were the same for both groups. They were the abilities to: (1) figure rate of return per dollar invested on each enterprise on the farm; (2) take time for bookkeeping and analyzing the farm business; (3) figure feed fed to each livestock enterprise; (4) determine labor used in various enterprises; (5) know economic principles of diminishing returns; (6) figure management returns; (7) know percentage of income used for family living.

The ability to file accurate annual income tax returns received the highest mean score rating and the highest degree of competence possessed by both groups, the association members and the random sample farmers. Two additional abilities were rated among the top five abilities needed by both groups and they were: (1) ability to take time for bookkeeping and analyzing your business and (2) ability to recognize the probability of profit from various feeding and cropping programs.

Christy wrote about the significance of the competencies in his summary and made recommendations as follows (7, p. 118):

> The 40 competencies in farm business analysis have importance in planning educational programs. They should form the basis for instruction and in-service training in vocational agriculture classes for youth, young and adult farmers, in the extension service program, in area vocational schools, and in the College of Agriculture resident instruction program.

No studies of competencies required for seed production and distribution were found by the investigator. There were studies dealing with competencies needed in other agricultural businesses and in other farm enterprise areas. Most of these studies identified competencies closely associated with agriculture and related business activities. This study is similar in design to some of the completed competence studies referred to in the review of literature. The review of literature was helpful in designing the method of procedure and the statistical treatment of the data collected.

The conclusions of the studies which have been reviewed indicate the following:

1. There are specific competencies required for employment in agricultural production and agricultural businesses.
2. Agriculture has great breadth and is complex. It involves professional, technical, and vocational occupations which require high degrees of competence for successful performance by employees.
3. These specific competencies can be taught in high school vocational agriculture, in area vocational-technical schools, and in land grant colleges.

4. Agricultural education programs should be characterized in terms of a close relationship to the agricultural business or industrial occupation.

METHOD OF PROCEDURE

The main objective of the study was to determine competencies needed by employees in the seed production and distribution industry. Secondary objectives were to determine (1) the degree of competence possessed by the employees of the seed production and distribution industry and (2) relationships between the competencies and characteristics of the seed industry and of the employees of the seed production and distribution industry. A competency was defined as an ability or understanding needed in efficient seed production and distribution.

A meeting was held with Mr. Robert L. Skinner, secretary of the Iowa Seed Dealers Association, to select a panel of specialists from that association to assist in determining a list of abilities and understandings needed by employees employed in seed production and distribution. Another meeting was held with Dr. Charles D. Hutchcroft, secretary of the Iowa Crop Improvement Association, to select a panel of specialists from that association.

The specialists were selected on the basis of their knowledge and experience in seed production and distribution. The final panel consisted of six men from the Iowa Crop Improvement Association membership and six men from the Iowa Seed Dealers Association membership.

The 12 specialists were contacted by personal interview and by mail by the investigator and requested to submit a list of abilities and understandings needed by employees in seed production and distribution. A preliminary composite list of competencies was developed from the lists received from the panel members by Dr. Charles D. Hutchcroft, Mr. Robert L.

Skinner and the investigator. The preliminary list was submitted to the panel members for further suggestions. A list of 49 competencies composed of 28 abilities and 21 understandings resulted. A managers questionnaire and a selected employee's questionnaire were developed which included the final list of 49 competencies. Copies of the questionnaires are included in the appendix. The two questionnaires differed in that the employer questionnaire provided space for information about the industry. The questionnaires were designed to obtain the following information about the industry:

1. Average number of employees per month.
2. Kind of seed activities.
3. Type of seed business.
4. Future needs for employees.

The following information was obtained about the employees:

1. Total years experience in seed business.
2. Years experience at present job.
3. Years experience with present organization.
4. Years lived on a farm after age 12.
5. Age.
6. Years of vocational agriculture completed.
7. Years of school completed.
8. Months attended at technical, vocational or commercial school.

The employees were asked to evaluate the degree of competence needed in each competency as follows: 4 - very much competence needed; 3 - much competence needed; 2 - some competence needed; 1 - little competence needed; 0 - no competence needed. The employees were also asked to evaluate the degree of competence possessed in each competency by using the same 0-4 scale.

A list of all companies doing business in seed production and distribution in Iowa was compiled from the membership lists of the Iowa Crop Improvement Association and the Iowa Seed Dealers Association. This list of companies was submitted to the secretary of each association to select the outstanding firms with 100 companies being selected by the secretaries. The investigator proceeded to use these dealers as the sample for the study.

Each company received three questionnaires from the investigator, one for the manager and two for selected employees. The nonmanagerial employees were divided into the following occupational areas:

1. Processing - All that is involved in changing the harvested seed to the merchandised product.
2. Production - All that is involved in planning, field management, and harvesting of the seed crop.
3. Sales - All that is involved in seed promotion, merchandising the seed, advertising, and services identified with sales transactions.
4. Service - All nonmanagerial maintenance, repair and unskilled labor.

Eighty usable questionnaires were obtained from the managers of companies and 40 usable questionnaires were obtained for three of the four following nonmanagerial occupational areas: (1) processing, (2) production, and (3) sales. The fourth nonmanagerial occupational area, service, was dropped from the study due to insufficient returns.

A check was made to determine if the returns from the respondents were representative of the entire sample. The investigator obtained questionnaires from three of the nonrespondents in each nonmanagerial occupational area by contacting them by personal follow-up. Study of the returns of the nonrespondents indicated they were similar to the respondents.

Information obtained from the usable questionnaires was coded by the investigator and placed on data processing cards. The data were machine tabulated by the Computation Center at Iowa State University.

FINDINGS AND DISCUSSION

Competencies in Seed Production and Distribution

The 49 competencies in seed production and distribution needed by managers and sales personnel determined by a panel of specialists are presented in Table 1. Twenty-eight of the competencies were abilities and 21 were understandings. The mean scores for the degree of competence needed and possessed in each competency by both the managers and sales personnel are shown.

The high overall competence needed mean score for individual abilities was 3.6, and the score was the same for both the managers and sales personnel. That competency was the ability to make sound decisions unaided.

The four abilities with next highest competence needed mean scores for managers also ranked among the abilities with the highest competence needed mean scores for sales personnel. The abilities and respective competence needed scores for managers and sales personnel were the abilities to (1) delegate responsibilities so employee can pursue work expected of him (3.5 and 3.5), (2) communicate effectively both orally and in writing (3.5 and 3.4), (3) use quality control measures to maintain quality of seed (3.5 and 3.3), and (4) work cooperatively under adverse conditions (3.5 and 3.2).

Five other abilities with high competence needed scores for managers also ranked high for competence needed by sales personnel. The abilities and respective competence needed mean scores for managers and sales personnel are the following: (1) advise customers on seed selection (3.4 and 3.5); (2) utilize and explain a seed tag (3.4 and 3.3); (3) properly operate cleaning and processing equipment (3.4 and 3.0); (4) collect, analyze

Table 1. Competencies needed and possessed by managers and sales personnel in seed production and distribution

Competencies	Mean scores[a]			
	Managers N = 80		Sales N = 40	
	Needed	Possessed	Needed	Possessed
Ability to:				
1. Identify common and noxious weed seeds	2.9	2.3	2.8	2.3
2. Identify kinds of seeds	3.0	2.4	2.9	2.8
3. Identify insects and diseases	3.1	2.2	3.0	2.1
4. Recognize major plant nutrient deficiencies	3.0	2.1	3.2	2.2
5. Safely apply and handle agricultural chemicals	3.1	2.5	3.3	2.3
6. Collect moisture samples and harvest at correct time	3.2	3.0	2.8	2.5
7. Prepare seedbed, plan planting rates and plant population	3.1	3.0	3.0	2.7
8. Use quality control measures to maintain quality of seed	3.5	2.9	3.3	2.7
9. Plan and schedule processing operations	3.3	3.1	3.1	2.4
10. Properly operate cleaning and processing equipment	3.4	2.7	3.0	2.1
11. Use and maintain scales, testing equipment and sampling devices	3.1	2.7	2.8	2.3

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[a] 0 = no competence needed (or possessed), 1 = little competence needed (or possessed), 2 = some competence needed (or possessed), 3 = much competence needed (or possessed), 4 = very much competence needed (or possessed).

Table 1 (Continued)

Competencies	Mean scores[a]			
	Managers N = 80		Sales N = 40	
	Needed	Possessed	Needed	Possessed
12. Work cooperatively under adverse conditions	3.5	2.9	3.2	2.6
13. Properly aerate and ventilate seed and storage area	3.1	2.8	2.8	2.1
14. Utilize and explain a seed tag	3.4	3.2	3.3	3.2
15. Assist producers in seed, crop and demonstration plot problems	3.0	2.7	2.8	2.4
16. Advise customers on seed selection	3.4	3.0	3.5	3.1
17. Effectively present merchandise and sell directly to consumers	3.1	2.8	3.4	3.0
18. Write legible sales slips and purchase orders	3.0	2.7	2.9	3.0
19. Calibrate, repair and maintain production and processing equipment	3.0	2.3	2.6	1.9
20. Keep an orderly tool and material room and office	2.8	2.3	2.7	2.4
21. Be precise in observations and techniques	3.2	2.7	3.1	2.7
22. Anticipate short and long range farming trends	3.0	2.5	3.1	2.6
23. Effectively use credit ratings and procedures	3.0	2.7	3.0	2.7
24. Make sound decisions unaided	3.6	3.0	3.6	3.1

Table 1 (Continued)

Competencies	Mean scores[a]			
	Managers N = 80		Sales N = 40	
	Needed	Possessed	Needed	Possessed
25. Delegate responsibilities so employee can pursue work expected of him	3.5	2.9	3.5	3.0
26. Communicate effectively both orally and in writing	3.5	2.9	3.4	2.9
27. Collect, analyze data and draw conclusions	3.3	2.7	3.3	2.7
28. Plan routes for most economical transportation	2.7	2.6	2.6	2.5
Overall mean score for abilities	3.2	2.7	3.1	2.6
Understanding of:				
29. Plant propagation and reproduction	3.0	2.5	2.9	2.1
30. Seed certification	2.9	2.6	3.1	3.0
31. Genetic pedigree information	2.7	2.2	2.8	1.8
32. Seed viability, purity, and germination	3.3	2.9	3.1	2.7
33. State and Federal seed laws	3.2	2.7	3.0	2.6
34. Governmental programs effect on seed sales	2.9	2.4	3.0	2.6
35. Seed production cycles and trends	3.0	2.4	3.1	2.5
36. Research projects, including sampling, controls, and acceptable analysis procedures	2.8	2.2	2.9	2.1
37. Production contracts	3.0	2.7	3.0	2.5

Table 1 (Continued)

Competencies	Mean scores[a]			
	Managers N = 80		Sales N = 40	
	Needed	Possessed	Needed	Possessed
38. Cost of production per unit	3.1	2.7	3.1	2.5
39. Potential variety production and market control	3.0	2.4	3.4	2.5
40. Seed promotion	3.1	2.4	3.7	2.8
41. Customer buying motivation	3.1	2.5	3.6	2.9
42. Crop maturity and planting dates	3.3	3.1	3.2	2.7
43. Soil sampling, fertilizer recommendations and fertilizer selection and use	3.0	2.6	3.0	2.5
44. Soil conservation	2.7	2.4	2.6	2.3
45. Chemical, biological and mechanical treatment of seed	3.1	2.7	3.2	2.5
46. Seed movement and storage	3.1	2.7	2.8	2.6
47. Seed drying procedures	3.1	3.0	2.9	2.6
48. Limitations of stacking sacks and packages	2.8	2.7	2.2	2.2
49. Service manuals for operating, repair and maintenance	2.7	2.4	2.1	2.0
Overall mean score for understandings	3.1	2.7	3.1	2.6
Total overall mean score	3.1	2.7	3.1	2.6

data and draw conclusions (3.3 and 3.3); and (5) plan and schedule processing operations (3.3 and 3.1).

The high overall competence possessed mean score for individual abilities was 3.2 and was the same for the managers and sales personnel. The ability was to utilize and explain a seed tag.

Three other abilities with high scores for competence possessed by the managers were ranked lower by sales personnel. The abilities and respective competence possessed scores for managers and sales personnel were (1) plan and schedule processing operations (3.1 and 2.4); (2) prepare seedbed, plan planting rates and plant population (3.1 and 2.7); and (3) collect moisture samples and harvest at correct time (3.0 and 2.5).

The five abilities with the next highest competence possessed scores for managers were ranked higher by sales personnel. The abilities and respective competence possessed scores for managers and sales personnel were (1) advise customers on seed selection (3.0 and 3.1), (2) make sound decisions unaided (3.0 and 3.1), (3) delegate responsibilities so employee can pursue work expected of him (2.9 and 3.0), (4) effectively present merchandise and sell directly to consumers (2.8 and 3.0), and (5) write legible sales slips and purchase orders (2.7 and 3.0).

Only one ability had a higher competence possessed mean score than for competence needed. The sales personnel indicated that they possessed more competence in the ability to write legible sales slips and purchase orders than was needed (2.9 and 3.0).

Two abilities had low mean scores for degree of competence needed by both managers and sales personnel. They were the abilities to (1) plan routes for most economical transportation (2.7 and 2.6), and (2) keep an orderly tool and material room and office (2.8 and 2.7).

The sales personnel had an additional six abilities with low mean scores for competence needed. The abilities and mean scores were (1) calibrate, repair and maintain production and processing equipment (2.7); (2) identify common and noxious weed seeds (2.8); (3) assist producers in seed, crop and demonstration plot problems (2.8); (4) properly aerate and ventilate seed and storage area (2.8); (5) use and maintain scales, testing equipment and sampling devices (2.8); and (6) collect moisture samples and harvest at correct time (2.8).

The understanding of seed promotion (3.7) was the competency with the highest mean score for competence needed by sales personnel among all abilities or understandings.

Sales personnel had the next two highest mean scores for competence needed in understandings. These were for the understandings of (1) customer buying motivation (3.6), and (2) potential variety production and market control (3.4).

The understandings with the highest competence needed scores for managers also were ranked high by sales personnel. The understandings and respective competence needed scores for managers and sales personnel were (1) crop maturity and planting dates (3.3 and 3.2); (2) seed viability, purity, and germination (3.3 and 3.1); (3) state and federal seed laws (3.2 and 3.0); and (4) understanding chemical, biological and mechanical treatment of seed (3.1 and 3.2).

The understandings with high competence possessed mean scores for managers were the understanding of (1) crop maturity and planting (3.1); (2) seed drying procedures (3.0); and (3) seed viability, purity, and germination (2.9).

The understandings with high competence possessed mean scores for sales personnel were the understanding of (1) seed certification (3.1), and (2) customer buying motivation (2.9).

Five understandings with low mean scores for competence needed were the same for both managers and sales personnel. The competencies and respective mean scores for managers and sales personnel were understanding (1) service manuals for operating, repair and maintenance (2.7 and 2.1); (2) genetic pedigree information (2.7 and 2.8); (3) soil conservation (2.7 and 2.6); (4) limitations of stacking sacks and packages (2.8 and 2.2); and (5) understanding research projects, including sampling, controls, and acceptable analysis procedures (2.8 and 2.9).

The managers and sales personnel had the lowest mean score for competence possessed in the understanding of genetic pedigree information (2.2 and 1.8). Other competencies ranked low by both managers and sales personnel were the understanding of (1) research projects, including sampling, controls, and acceptable analysis procedures (2.2 and 2.1); (2) service manuals for operating, repair and maintenance (2.4 and 2.0); and (3) understanding plant propagation and reproduction (2.5 and 2.1).

Twenty-five of 28 abilities and 14 of 21 understandings in seed production and distribution were rated much competence needed (2.0 or higher) by the managers. The sales personnel rated 31 of 49 competencies 3.0 or higher.

Of the five highest overall competence needed mean scores for individual abilities for both the managers and sales personnel, only one was related to an agricultural competency, whereas the other four were related to management and business competencies. The one agricultural competency was the ability to use quality control measures to maintain quality of seed. The other four competencies dealt with making decisions, delegate responsibilities, communicating, and working cooperatively. However, 29 of the total 39 competencies rated much competence needed are basic agricultural understandings and abilities.

Some implications for educational programs may be drawn from these data:

1. Keep the basic agricultural curriculum with emphasis on basic science and technology.
2. Leadership training, human relations, management, and salesmanship need to be strengthened in future educational programs.

These 49 competencies should be useful in planning instructional programs related to seed production and distribution.

The ranges in mean scores for the degree of competence needed and possessed and in overall mean scores for managers and sales personnel are summarized in Table 2.

Competence needed mean scores for individual competencies ranged from a low of 2.1 for sales personnel and 2.7 for managers to 3.7 for sales personnel and 3.6 for managers. Competence possessed scores ranged from a low of 1.8 for sales personnel and 2.1 for managers to 3.1 for both managers and sales personnel. The overall mean score for competence in abilities needed by managers was slightly higher (3.2) than competence needed in understandings and total competencies (3.1). The overall mean scores for understandings needed by sales personnel and by managers were the same (3.1).

Table 2. Mean scores for degree of competence needed and possessed by managers and sales personnel

Overall mean score	Mean scores Managers Degree needed	 Degree possessed	 Difference	 Sales Degree needed	 Degree possessed	 Difference
Abilities	3.2	2.7	0.5	3.1	2.6	0.5
Range	2.7-3.6	2.1-3.1		2.6-3.5	1.9-3.1	
Understanding	3.1	2.7	0.4	3.1	2.6	0.5
Range	2.7-3.3	2.2-3.1		2.1-3.7	1.8-3.0	
Total	3.1	2.7	0.4	3.1	2.6	0.5
Range	2.7-3.6	2.1-3.1		2.1-3.7	1.8-3.1	

The overall mean scores for competence possessed in understandings and in abilities were slightly higher (2.7) for managers than for sales personnel (2.6). The difference between total overall mean scores for competence needed and possessed was slightly larger for the sales personnel (0.5) than for managers (0.4).

Competencies with mean score differences of 0.6 or larger between the degree of competence needed and possessed scores are presented in Table 3. Abilities with largest differences between competence needed and competence possessed scores and respective differences for managers and sales personnel were (1) recognize major plant nutrient deficiencies (0.9 and 1.0), (2) identify insects and diseases (0.9 and 0.9), (3) properly operate cleaning and processing equipment (0.7 and 0.9), and (4) safely apply and handle agricultural chemicals (0.6 and 1.0).

Table 3. Competencies in seed production and distribution needed by managers and sales personnel with differences of 0.6 or larger between degree of competence needed and possessed mean scores

Competencies	Mean score difference	
	Managers	Sales
Ability to:		
1-28		
Understanding of:		
Abilities		
4.	0.9	1.0
3.	0.9	0.9
10.	0.7	0.9
19.	0.7	0.7
5.	0.6	1.0
8.	0.6	0.6
12.	0.6	0.6
27.	0.6	0.6
24.	0.6	(0.5)
25.	0.6	(0.5)
1.	0.6	(0.5)
2.	0.6	(0.1)
13.	(0.3)	0.7
9.	(0.2)	0.7
Understandings		
40.	0.7	0.9
39.	0.6	0.9
36.	0.6	0.8
41.	0.6	0.7
35.	0.6	0.6
31.	(0.5)	1.0
29.	(0.5)	0.8
45.	(0.4)	0.7
38.	(0.4)	0.6

Understandings with largest differences between competence needed and possessed scores and respective differences for managers and sales personnel were (1) genetic pedigree information (0.5 and 1.0), (2) seed promotion (0.7 and 0.9), and (3) customer buying motivation (0.6 and 0.9).

Mean score differences of 0.6 or larger were found for 17 competencies for managers and for 19 competencies for sales personnel.

Both managers and sales personnel indicated that all 49 competencies were needed. The degree of competence needed ranged from more than some (2.1) to slightly below very much competence needed (3.7).

The four abilities with the largest differences between competence needed and competence possessed scores presented in Table 4 are all agricultural abilities, which indicates the need for continuing an agricultural curriculum. Of the three understandings with the widest differences between competence needed and possessed scores, two related directly to the sales and business understandings, which indicated the need for the inclusion of salesmanship in future curriculums.

Four of the five highest competence needed mean scores for individual abilities by production and processing personnel were the same for both groups. They were (1) work cooperatively under adverse conditions (3.3 and 3.4), (2) use quality control measures to maintain quality of seed (3.2 and 3.4), (3) properly operate cleaning and processing equipment (3.2 and 3.3), and (4) make sound decisions unaided (3.2 and 3.3). The other competency needed by production personnel was the ability to safely apply and handle agricultural chemicals (3.3).

The abilities with the next highest competence needed mean scores were the same for production and processing personnel. The abilities and re-

Table 4. Competencies needed and possessed by production and processing personnel in seed production and distribution

Competencies	Mean scores			
	Production N = 40		Processing N = 40	
	Needed	Possessed	Needed	Possessed
Ability to:				
1.	2.6	2.2	2.7	1.9
2.	2.7	2.4	3.1	2.4
3.	3.2	2.1	2.7	1.9
4.	3.2	2.4	2.6	1.6
5.	3.3	2.5	2.7	2.2
6.	3.2	2.7	3.1	2.7
7.	3.2	2.9	2.7	2.5
8.	3.2	2.6	3.4	2.9
9.	3.1	2.5	3.2	2.8
10.	3.2	2.4	3.3	2.8
11.	3.2	2.6	3.2	2.8
12.	3.3	2.6	3.4	3.0
13.	3.0	2.4	3.0	2.7
14.	2.9	2.5	2.8	2.5
15.	2.7	2.0	2.4	2.0
16.	2.8	2.2	2.8	2.1
17.	2.3	2.0	2.3	1.7
18.	2.5	2.4	2.5	2.3
19.	3.1	2.3	3.2	2.5
20.	2.8	2.3	3.0	2.7
21.	3.2	2.5	3.2	2.7
22.	2.7	2.0	2.4	1.7
23.	2.1	1.8	2.1	1.4
24.	3.2	2.6	3.3	2.7
25.	3.1	2.6	3.1	2.8
26.	3.1	2.4	3.0	2.4
27.	3.0	2.3	2.9	2.5
28.	2.2	1.9	2.5	2.5
Overall mean score for abilities	2.9	2.3	2.9	2.4
Understanding of:				
29.	3.0	2.3	2.6	1.9
30.	3.1	2.3	2.7	2.0
31.	2.9	1.9	2.3	1.4
32.	3.4	2.6	3.0	2.4

Table 4 (Continued)

Competencies	Mean scores			
	Production N = 40		Processing N = 40	
	Needed	Possessed	Needed	Possessed
33.	3.1	2.0	2.8	2.1
34.	2.8	1.9	2.2	1.7
35.	2.7	1.8	2.2	1.7
36.	3.2	1.7	2.6	1.8
37.	3.2	2.2	2.4	1.8
38.	3.1	2.0	2.4	2.0
39.	2.9	1.7	2.3	1.5
40.	2.8	1.8	2.3	1.7
41.	2.8	1.6	2.4	1.7
42.	3.3	2.7	3.0	2.5
43.	3.3	2.4	2.6	1.9
44.	2.9	2.3	2.2	1.8
45.	3.1	2.4	3.2	2.6
46.	2.9	2.3	3.2	3.0
47.	3.2	2.6	3.3	2.6
48.	2.6	2.4	3.1	2.8
49.	2.8	2.5	3.0	2.6
Overall mean score for understandings	3.0	2.2	2.7	2.1
Total overall mean score	2.9	2.2	2.8	2.3

spective competence needed scores for production and processing personnel were the abilities to (1) be precise in observations and techniques (3.2 and 3.2); (2) use and maintain scales, testing equipment and sampling devices (3.2 and 3.2); (3) collect moisture samples and harvest at correct time (3.2 and 3.1); (4) plan and schedule processing operations (3.1 and 3.2); (5) calibrate, repair and maintain production and processing equipment (3.1 and 3.2); (6) prepare seedbed, plan planting rates and plant population (3.2 and 2.7); (7) identify insects and diseases (3.2 and 2.7); and

(8) recognize major plant nutrient deficiencies (3.2 and 2.6).

The ability to work cooperatively under adverse conditions was the competency with the highest mean score possessed by the processing personnel group with a mean score of 3.0. The next highest mean score for competence possessed by the processing personnel was the ability to use quality control measures to maintain quality of seed (2.9).

Production employees ranked the ability to prepare seedbed, plan planting rates and plant population as the highest degree of competence possessed with a mean score of 2.9.

Five other abilities with high competence possessed scores for production and processing personnel and respective mean scores were (1) collect moisture samples and harvest at correct time (2.7 and 2.7); (2) delegate responsibilities so employee can pursue work expected of him (2.6 and 2.8); (3) make sound decisions unaided (2.6 and 2.7); (4) be precise in observations and techniques (2.5 and 2.7); and (5) properly aerate and ventilate seed and storage area (2.4 and 2.7).

The production and processing personnel had the lowest mean score for competence needed in the individual ability to effectively use credit ratings and procedures (2.1). Two other competencies ranked low by the processing personnel were (1) assist producers in seed, crop, and demonstration plot problems (2.4); and (2) anticipate short and long range farming trends (2.4).

Three abilities had low mean scores for degree of competence needed by both production and processing personnel. They were the abilities to (1) plan routes for most economical transportation (2.2 and 2.5), (2) effectively present merchandise and sell directly to consumers (2.3 and 2.3), and (3) write legible sales slips and purchase orders (2.5 and 2.5).

Production and processing personnel had the lowest mean score for competency possessed in the ability to effectively use credit ratings and procedures (1.8 and 1.4). Another competency ranked low by the processing personnel was the ability to recognize major plant nutrient deficiencies (1.6). Production personnel had the lowest mean score for competence possessed in the ability to plan routes for most economical transportation (1.9).

Six abilities with low mean scores for competence possessed were the same for both production and processing personnel. The competencies and respective mean scores for production and processing personnel were the abilities to (1) effectively present merchandise and sell directly to consumers (2.0 and 1.7); (2) anticipate short and long range farming trends (2.0 and 1.7); (3) identify insects and diseases (2.1 and 1.9); (4) identify common and noxious weed seeds (2.2 and 1.9); (5) assist producers in seed, crop, and demonstration plot problems (2.0 and 2.0); and (6) advise customers on seed selection (2.2 and 2.1).

Four of the nine understandings with the highest mean scores for competence needed were the same for both the production and processing personnel. They were the understandings of (1) seed viability, purity, and germination (3.4 and 3.0); (2) crop maturity and planting dates (3.3 and 3.0); (3) seed drying procedures (3.2 and 3.3); and (4) chemical, biological and mechanical treatment of seed (3.1 and 3.2).

Three of the nine understandings with the highest mean scores for competence needed by production personnel were (1) soil sampling, fertilizer recommendations and fertilizer selection and use (3.3); (2) research projects, including sampling, controls, and acceptable analysis procedures (3.2); and (3) production contracts (3.2).

The other two understandings needed by processing personnel were (1) seed movement and storage (3.2), and (2) limitations of stacking sacks and packages (3.1).

Processing personnel had the highest degree of competence possessed in understandings. They were (1) seed movement and storage (3.0), and (2) limitations of stacking sacks and packages (2.8). Both production and processing personnel had the next highest degree of competence possessed in understandings. They were (1) drop maturity and planting dates (2.7 and 2.5); (2) seed drying procedures (2.6 and 2.6); (3) seed viability, purity and germination (2.6 and 2.4); (4) service manuals for operating, repair, and maintenance (2.5 and 2.6); and (5) chemical, biological, and mechanical treatment of seed (2.4 and 2.6).

Seven understandings with low mean scores for competence needed were the same for production and processing personnel. The competencies and respective mean scores were (1) seed production cycles and trends (2.7 and 2.2); (2) governmental programs effect on seed sales (2.8 and 2.2); (3) soil conservation (2.9 and 2.2); (4) seed promotion (2.8 and 2.3); (5) potential variety production and market control (2.9 and 2.3); and (6) genetic pedigree information (2.9 and 2.3).

Processing personnel had the lowest mean scores for competence possessed in the understanding of genetic pedigree information (1.4). Other competencies ranked low by both production and processing personnel were the understanding of (1) customer buying motivation (1.6 and 1.7); (2) potential variety production and market control (1.7 and 1.5); (3) research projects, including sampling, controls, and acceptable analysis procedures (1.7 and 1.8); (4) seed promotion (1.8 and 1.7); (5) seed production cycles and trends (1.8 and 1.7); and (6) governmental programs effect on seed sales (1.9 and 1.7).

The ranges in degree of competence needed and possessed mean scores and overall mean scores for production and processing personnel are summarized in Table 5.

Table 5. Mean scores for degree of competence needed and possessed by production and processing personnel

Overall mean score	Mean scores					
	Production			Processing		
	Degree needed	Degree possessed	Difference	Degree needed	Degree possessed	Difference
Abilities	2.9	2.3	0.3	2.9	2.4	0.5
Range	2.2-3.3	1.8-2.9		2.1-3.4	1.4-3.0	
Understanding	3.0	2.2	0.8	2.7	2.1	0.6
Range	2.6-3.4	1.6-2.7		2.2-3.3	1.4-3.0	
Total	2.9	2.2	0.7	2.8	2.5	0.6
Range	2.2-3.4	1.6-2.9		2.1-3.4	1.4-3.0	

Competence needed mean scores for individual competencies ranged from a low of 2.1 for processing personnel and 2.2 for production to 3.4 for both production and processing personnel. Competence possessed scores ranged from a low of 1.4 for processing personnel and 1.6 for production personnel to 2.9 for production and 3.0 for processing personnel.

The overall mean score for competence in understandings needed by production personnel was slightly higher (3.0) than competence needed in abilities (2.9). The overall mean score for competence in abilities needed by processing personnel was higher (2.9) than competence needed in understanding (2.7).

The overall mean score for competence possessed in abilities by production and processing personnel were higher (2.3 and 2.4) than for competence possessed in understandings (2.2 and 2.1).

The largest difference between overall mean scores for competence needed and possessed was (0.8) for production personnel in understandings. The smallest difference between overall mean scores for competence needed and possessed was (0.3) for production personnel in abilities. Processing personnel had differences between needed and possessed of 0.6 for understanding and 0.5 for abilities.

Competencies with mean score differences of 0.6 or larger between the degree of competence needed and competence possessed scores are presented in Table 6. Abilities with largest differences between competence needed and possessed and respective differences for production and processing personnel were (1) identify insects and diseases (1.1 and 0.8); (2) recognize major plant nutrient deficiencies (0.8 and 1.0); (3) calibrate, repair and maintain production and processing equipment (0.8 and 0.7); (4) properly operate cleaning and processing equipment (0.8 and 0.5); and (5) safely apply and handle agricultural chemicals (0.8 and 0.5).

Understandings with largest differences between competence needed and possessed scores and respective differences for production and processing personnel were (1) potential variety production and market control (1.2 and

Table 6. Competencies in seed production and distribution needed by production and processing personnel with differences of 0.6 or larger between degree of competence needed and possessed mean scores

Competencies	Mean score difference	
	Production	Processing
Abilities		
3.	1.1	0.8
4.	0.8	1.0
19.	0.8	0.7
10.	0.8	(0.5)
5.	0.8	(0.5)
22.	0.7	0.7
26.	0.7	0.6
21.	0.7	(0.5)
12.	0.7	(0.4)
27.	0.7	(0.4)
15.	0.7	(0.4)
16.	0.6	0.7
24.	0.6	0.6
8.	0.6	(0.5)
9.	0.6	(0.4)
11.	0.6	(0.4)
13.	0.6	(0.3)
1.	(0.4)	0.8
2.	(0.3)	0.7
22.	(0.3)	0.7
17.	(0.3)	0.6
Understandings		
39.	1.2	0.8
41.	1.2	0.7
31.	1.0	0.9
37.	1.0	0.6
40.	1.0	0.6
43.	0.9	0.7
33.	0.9	0.7
34.	0.9	(0.5)
35.	0.9	(0.5)
38.	0.9	(0.4)
30.	0.8	0.7
32.	0.8	0.6
29.	0.7	0.7

Table 6 (Continued)

Competencies	Mean score difference	
	Production	Processing
45.	0.7	0.6
47.	0.6	0.7
42.	0.6	(0.5)
44.	0.6	(0.4)
46.	0.6	(0.2)
36.	(0.5)	0.8

0.8); (2) customer buying motivation (1.2 and 0.7); (3) genetic pedigree information (1.0 and 0.9); (4) production contracts (1.0 and 0.6); and (5) seed promotion (1.0 and 0.6).

Mean score differences of 0.6 or larger were found for 17 of 28 abilities for production and 11 of 28 abilities for processing personnel. Mean score difference of 0.6 or larger were found for 18 of 21 understandings for production personnel and 13 of 21 understandings for processing personnel. The numbers of individual competencies where a mean score difference of 0.6 or more were 37 of the 49 competencies for production workers and 24 of the 49 competencies for processing workers.

Characteristics of Seed Businesses

Mean scores competencies needed and possessed by managers and sales personnel stratified by kind of seed classification are shown in Table 7. Overall degree of competence needed scores for abilities were close with the combination seed group having the highest score (3.2). The corn and/or sorghum group; corn, soybean and small grain group; and soybean, small

Table 7. Competencies needed and possessed by managers and sales personnel in seed production and distribution by kind of seed

Competencies	Mean scores							
	N = 34 1[a]		N = 12 2		N = 26 3		N = 48 4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities								
1.	2.2	2.1	2.9	2.5	3.4	2.7	3.1	2.2
2.	2.5	2.1	3.0	2.4	3.2	3.0	3.2	2.7
3.	3.1	2.3	3.2	2.7	2.8	1.9	3.1	2.0
4.	3.1	2.3	3.3	2.2	2.9	1.9	3.1	2.1
5.	3.4	2.7	3.2	2.0	2.7	2.3	3.3	2.3
6.	3.3	3.1	3.0	2.7	2.8	2.8	3.1	2.8
7.	3.0	2.9	2.9	2.9	3.0	2.8	3.2	2.9
8.	3.3	3.0	3.3	2.5	3.6	2.8	3.4	2.8
9.	3.2	3.1	3.3	2.9	3.3	2.9	3.2	2.7
10.	3.1	2.6	2.9	2.5	3.6	3.0	3.2	2.2
11.	2.7	2.6	3.2	2.7	3.0	2.8	3.1	2.5
12.	3.6	3.1	3.1	2.2	3.4	2.8	3.3	2.8
13.	3.1	2.9	3.3	2.6	2.9	2.2	3.0	2.5
14.	3.2	3.1	3.4	3.1	3.3	3.1	3.5	3.3
15.	2.9	2.7	3.0	2.7	2.7	2.7	3.1	2.5
16.	3.3	2.9	3.1	2.7	3.5	3.1	3.6	3.2
17.	3.0	2.7	2.7	2.5	3.4	2.9	3.4	3.0
18.	2.7	2.7	2.6	2.6	3.1	3.0	3.1	2.8
19.	2.8	2.4	3.1	2.3	2.9	2.5	2.8	1.8

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[a] (1) corn and/or sorghum, (2) corn, soybean and small grain, (3) soybean, small grain, grass and legumes, (4) combination of four or more kind of seed.

Table 7 (Continued)

Competencies	Mean scores							
	N = 34		N = 12		N = 26		N = 48	
	1[a]		2		3		4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
20.	2.8	2.5	2.9	2.3	2.8	2.5	2.7	2.2
21.	3.3	2.8	3.2	2.7	3.0	2.8	3.2	2.7
22.	2.8	2.4	3.3	2.9	3.1	2.8	3.2	2.4
23.	2.5	2.3	3.4	3.1	3.0	2.7	3.3	2.8
24.	3.6	3.0	3.6	3.1	3.5	3.0	3.6	3.0
25.	3.6	3.0	3.2	2.7	3.5	3.0	3.5	2.8
26.	3.5	2.8	3.2	3.0	3.1	2.7	3.6	3.0
27.	3.4	2.8	2.2	2.9	3.1	2.7	3.3	2.6
28.	2.7	2.6	2.2	2.1	2.7	2.7	2.8	2.6
Overall mean score for abilities	3.1	2.7	3.1	2.6	3.1	2.7	3.2	2.6
Understandings								
29.	3.3	2.8	2.4	2.2	2.7	2.4	3.1	2.2
30.	2.8	2.7	3.1	3.2	3.1	2.9	3.1	2.6
31.	2.7	2.1	2.8	2.2	2.5	2.0	2.8	2.0
32	3.5	3.2	3.1	2.6	3.1	2.9	3.2	2.7
33.	3.3	2.9	2.7	2.2	2.9	2.6	3.3	2.7
34.	2.8	2.3	2.8	2.2	2.8	2.5	3.2	2.6
35.	2.8	2.4	2.8	2.1	3.0	2.4	3.2	2.5
36.	2.9	2.3	2.9	2.1	2.8	2.2	2.8	2.1
37.	3.1	2.8	2.7	2.6	3.1	2.8	2.9	2.4
38.	3.3	2.8	2.9	2.5	3.2	2.8	3.0	2.5
39.	3.0	2.4	3.1	2.7	3.2	2.7	3.1	2.3

Table 7 (Continued)

Competencies	Mean scores							
	N = 34		N = 12		N = 26		N = 48	
	1^a		2		3		4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
40.	3.0	2.3	3.1	2.4	3.6	3.0	3.4	2.6
41.	3.0	2.4	3.1	2.0	3.4	2.8	3.4	2.8
42.	3.4	3.2	3.0	2.2	3.0	2.9	3.3	3.0
43.	3.2	3.0	2.7	2.4	2.8	2.8	3.0	2.2
44.	2.6	2.6	2.7	2.5	2.6	2.3	2.8	2.2
45.	3.2	3.0	3.0	2.7	3.3	2.7	3.1	2.3
46.	3.1	2.8	3.0	2.7	2.9	2.8	2.9	2.5
47.	3.5	3.3	3.1	2.7	2.6	2.7	2.9	2.6
48.	2.8	2.8	2.0	2.2	2.7	2.7	2.6	2.3
49.	2.8	2.6	2.2	2.0	2.6	2.2	2.4	2.1
Overall mean scores for understandings	3.0	2.7	2.8	2.4	2.9	2.6	3.0	2.4
Total overall mean scores	3.0	2.7	2.9	2.5	3.0	2.6	3.1	2.5

grain, grass and legumes group had identical scores of 3.1.

Both corn and/or sorghum group; and soybean, small grain, grass and legumes group had the high ability possessed overall mean score of 2.7. However, both corn, soybean and small grain group and combination group were close with a competence possessed score of 2.6. Differences between mean scores for abilities needed and possessed were largest for the combination of four or more kinds of seed group (0.6), and lowest for corn and/or sorghum group, and for the soybean, small grain, grass and legumes group (0.4).

The highest overall competence needed mean score for understanding was 3.0 for both the corn and/or sorghum group and for the combination of four or more kind of seed group. The soybean, small grain, grass and legumes group had the low understandings needed overall mean score of 2.6. The corn, soybean and small grain group was intermediate with 2.8.

The corn and/or sorghum group had the highest overall competence possessed mean score for understandings of 2.7, with the soybean, small grain, grass and legumes group close with a mean score of 2.6. Both corn, soybean and small grain group, and the combination group had the lowest overall competence possessed mean score for understandings of 2.4. Widest difference between overall competence needed and possessed mean scores for understandings was for the combination of four or more kinds of seed group (0.6). Differences of 0.4, 0.3, and 0.3 were found for the corn, soybean and small grain group, corn and/or sorghum group, and for the soybean, small grain, grass and legumes groups respectively.

The combination of four or more kinds of seed group had the largest total overall competence needed mean score of 3.1. The corn and/or sorghum group, and the soybean, small grain, grass and legumes group were intermediate with a competence needed mean score of 3.0, whereas the corn, soybean and small grain group was lowest with a total overall competence needed mean score of 2.9.

The corn and/or sorghum group had the largest total overall competence possessed mean score of 2.7. The soybean, small grain, grass and legumes group followed close with a overall competence possessed mean score of 2.6. The corn, soybean and small grain and the combination of four or more kinds of seed groups had identical competence possessed mean scores of 2.5.

The total overall competence needed and possessed mean score difference was largest for the combination of four or more kinds of seed group (0.6), intermediate for the corn, soybean and small grain group (0.4), soybean, small grain, grass and legumes group (0.4), and smallest for the corn and/or sorghum group (0.3).

Some variation was found among the mean scores for competence needed with the managers and sales personnel who were employees of firms that handled four or more kinds of seed indicating that higher degrees of competencies were needed. Yet, they possessed less competence than the other managers and sales personnel by kind of seed classification.

Corn and/or sorghum group employees had the highest possessed competence of the different groups of employees by kind of seed classification and the smallest differences between competence needed and possessed mean scores for individual competencies.

However, the kind of seed classification of the seed firm seemed to have only slight effect on the average mean scores of the managers and sales personnel.

Mean scores for competence needed and possessed by production and processing personnel stratified by kind of seed classification are shown in Table 8. Overall degree of competence needed scores for abilities were close with the combination seed group having most competence (3.0). The other three groups and their respective competence scores revealed a trend as follows: (1) soybean, small grain, grass and legumes group (2.9); (2) corn and/or sorghum group (2.8); and (3) corn, soybean and small grain group (2.7).

The highest overall competence possessed mean score for abilities was 2.5 for the corn and /or sorghum group. The other three groups had identical overall mean scores for abilities of 2.3.

Differences between abilities needed and possessed overall scores were highest for the combination of four or more kinds of seed group (0.7), and lowest for corn and/or sorghum group (0.3).

The highest overall competence needed mean score for understanding was 2.9 for both the corn, soybean and small grain, and the soybean, small grain, grass and legumes groups. The lowest overall competence needed mean score for understanding was 2.8 for both the corn and/or sorghum group, and for the combination of four or more kinds of seed group.

Both corn and/or sorghum group and soybean, small grain, grass and legumes group had the highest overall competence possessed mean score for understanding of 2.2. The lowest overall competence possessed mean score for understandings was 2.0 by both the corn, soybean and small grain group and the combination of four or more kinds of seed group.

Widest differences between overall competence needed and possessed mean scores for understandings was for the corn, soybean and small grain

Table 8. Competencies needed and possessed by production and processing personnel in seed production and distribution by kind of seed

Competencies	Mean scores							
	N = 36		N = 7		N = 13		N = 24	
	1[a]		2		3		4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities								
1.	2.1	1.9	2.4	1.6	3.5	2.6	3.2	2.2
2.	2.4	2.4	3.1	1.9	3.1	2.5	3.5	2.5
3.	2.9	2.2	3.1	1.9	2.8	1.9	3.0	1.7
4.	2.9	2.2	2.7	1.6	2.6	1.8	3.0	1.8
5.	3.3	2.6	2.9	2.6	2.8	1.6	2.8	2.4
6.	3.3	3.0	3.0	2.6	2.7	2.4	3.2	2.5
7.	3.1	2.9	2.7	2.7	2.7	2.3	3.0	2.6
8.	3.4	3.0	3.0	2.7	3.0	2.5	3.5	2.5
9.	3.2	2.9	2.8	2.8	3.0	2.3	3.2	2.4
10.	3.3	2.8	2.9	2.9	3.2	2.4	3.4	2.3
11.	3.2	3.0	2.7	2.7	2.9	2.5	3.4	2.4
12.	3.4	3.0	3.0	2.0	3.1	2.5	3.4	2.8
13.	3.0	2.6	3.0	2.6	2.8	2.3	3.0	2.5
14.	2.9	2.8	2.3	2.3	2.7	2.3	3.2	2.4
15.	2.5	2.1	2.3	2.3	2.5	1.8	2.7	1.9
16.	2.6	2.2	2.7	2.1	2.9	2.1	3.2	2.2
17.	1.8	1.7	2.3	1.7	2.8	2.0	2.7	2.0
18.	2.3	2.3	3.3	2.6	2.9	2.6	2.5	2.1
19.	3.0	2.6	2.4	1.9	3.4	2.4	3.4	2.2
20.	2.9	2.6	2.7	2.1	2.9	2.5	2.8	2.3
21.	3.3	2.9	3.1	2.4	3.0	2.5	3.1	2.4

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[a] Same as on footnote in Table 7.

Table 8 (Continued)

	Mean scores							
	N = 36		N = 7		N = 13		N = 24	
Competencies	1^a		2		3		4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
22.	2.4	1.8	2.4	1.7	3.0	2.1	2.7	1.9
23.	1.9	1.7	2.1	1.3	2.7	1.7	2.3	1.6
24.	3.3	2.9	3.0	2.6	3.2	2.6	3.4	2.5
25.	3.3	2.8	3.0	2.7	3.1	2.5	2.9	2.6
26.	3.1	2.5	3.0	2.3	3.0	2.5	2.9	2.2
27.	2.9	2.6	3.0	2.6	3.0	2.4	2.9	2.2
28.	2.3	2.2	2.1	2.3	3.0	2.1	2.2	2.3
Overall mean score for abilities	2.8	2.5	2.7	2.3	2.9	2.3	3.0	2.3
Understandings								
29.	2.9	2.5	2.9	1.7	2.8	1.8	2.7	1.9
30.	2.6	2.2	2.7	2.1	3.1	2.1	3.3	2.3
31.	2.4	1.7	2.7	1.6	2.7	1.8	2.7	1.7
32.	3.4	2.8	3.0	2.3	2.8	2.2	3.3	2.3
33.	3.1	2.2	2.7	1.7	2.8	2.2	2.9	1.9
34.	2.4	1.9	2.4	1.6	2.7	2.1	2.6	1.8
35.	2.4	1.8	2.4	1.6	2.8	1.9	2.4	1.6
36.	3.2	2.0	2.6	1.4	2.9	1.8	2.5	1.5
37.	2.9	2.2	3.0	2.0	3.0	2.1	2.6	1.7
38.	2.8	2.0	2.6	2.0	2.9	2.3	2.6	1.7
39.	2.3	1.5	2.9	1.6	3.0	1.9	2.6	1.7
40.	2.4	1.7	2.6	1.9	2.8	1.9	2.6	1.7
41.	2.4	1.4	2.6	1.4	2.9	2.0	2.8	1.8

Table 8 (Continued)

Competencies	Mean scores							
	N = 36 1^a		N = 7 2		N = 13 3		N = 24 4	
	Needed	Possessed	Needed	Possessed	Needed	Possessed	Needed	Possessed
42.	3.2	2.8	2.9	2.3	3.0	2.5	3.2	2.5
43.	3.2	2.5	3.1	2.3	2.9	1.9	2.6	1.8
44.	2.6	2.1	2.7	1.7	2.6	2.3	2.5	1.9
45.	3.2	2.7	3.3	2.7	3.2	2.4	3.2	2.2
46.	3.0	2.6	3.4	3.1	2.7	2.5	3.1	2.5
47.	3.3	2.9	3.3	2.1	2.8	2.4	3.4	2.4
48.	2.6	2.9	3.3	2.6	2.8	2.8	3.1	2.2
49.	2.8	2.7	3.1	2.3	2.9	2.7	3.1	2.3
Overall mean score for understandings	2.8	2.2	2.9	2.0	2.9	2.2	2.8	2.0
Total overall mean score	2.8	2.4	2.8	2.1	2.9	2.2	2.9	2.1

group (0.9). Differences of 0.8, 0.7 and 0.6 were found for the combination of four or more kinds of seed group; the soybean, small grain, grass and legumes group; and for the corn and/or sorghum group respectively.

The combination of four or more kinds of seed, and the soybean, small grain, grass and legumes groups had the highest total overall competence needed mean score of 2.9. The other two groups were close with a total overall competence needed mean score of 2.8.

The corn and/or sorghum group had the highest total overall competence possessed mean score of 2.4. The soybean, small grain, grass and legumes group was intermediate with a competence mean score possessed of 2.2, whereas the corn, soybean and small grain group, and the combination of four or more kinds of seed group were lowest with a total overall possessed mean score of 2.1.

The total overall competence needed and possessed mean score difference was largest for the combination of four or more kinds of seed group (0.8); close intermediates were the corn, soybean and small grain, and soybean, small grain, grass and legumes groups (0.7); and smallest was for the corn and/or sorghum group (0.4).

Characteristics of Seed Business Employees

Included in Table 9 are the mean scores for competence needed and possessed by managers and sales personnel stratified by the number of years experience in the seed business. The highest overall mean score for competence needed in abilities was 3.3 for the 31 or more years of experience in seed business. Both of the other two groups, 1 to 15 years and 16 to 30 years experience groups, had the same competence needed mean score of 3.1.

Table 9. Competencies needed and possessed by managers and sales personnel in seed production and distribution by the number of years experience in seed business

Competencies	Mean scores					
	N = 32		N = 68		N = 20	
	1-15 years		16-30 years		31 or more years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.6	2.2	3.0	2.3	3.1	2.4
2.	2.9	2.4	3.0	2.6	3.1	2.7
3.	3.2	2.4	3.0	2.1	3.0	2.0
4.	3.2	2.2	3.0	2.2	3.1	2.1
5.	3.0	2.3	3.2	2.4	3.4	2.6
6.	2.7	2.7	3.3	2.9	3.2	2.9
7.	3.0	2.6	3.0	3.0	3.4	3.0
8.	3.3	2.8	3.4	2.8	3.6	2.8
9.	3.2	2.5	3.3	3.0	3.4	3.1
10.	3.0	2.0	3.2	2.6	3.7	2.9
11.	2.8	2.4	2.9	2.6	3.5	3.0
12.	2.9	2.6	3.5	2.9	3.7	2.8
13.	3.0	2.5	2.9	2.5	3.3	2.9
14.	3.2	3.1	3.4	3.2	3.3	3.4
15.	3.3	2.8	2.8	2.6	2.9	2.3
16.	3.3	3.0	3.4	3.1	3.6	3.1
17.	3.2	2.7	3.2	2.8	3.1	3.0
18.	2.7	2.7	3.0	2.8	3.0	2.8
19.	2.7	1.8	2.9	2.2	3.1	2.6
20.	2.6	2.4	2.8	2.4	2.9	2.3
21.	3.3	2.8	3.1	2.7	3.2	2.6
22.	3.2	2.4	3.0	2.6	3.0	2.6
23.	3.2	2.7	3.0	2.7	2.9	2.7
24.	3.7	2.9	3.5	3.0	3.7	3.1
25.	3.5	2.7	3.5	2.9	3.6	3.0
26.	3.5	2.7	3.4	3.0	3.3	2.9
27.	3.6	2.8	3.2	2.7	3.3	2.8
28.	2.7	2.3	2.6	2.6	3.0	2.8
Overall mean score for abilities	3.1	2.5	3.1	2.7	3.3	2.8

Table 9 (Continued)

Competencies	Mean scores					
	N = 32 1-15 years		N = 68 16-30 years		N = 20 31 or more years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	3.0	2.4	2.9	2.3	3.2	2.7
30.	3.0	2.6	3.0	2.8	3.0	2.5
31.	3.0	2.2	2.5	1.9	3.0	2.2
32.	3.4	2.7	3.1	2.9	3.5	3.1
33.	3.2	2.5	3.0	2.7	3.5	2.9
34.	3.2	2.6	2.8	2.4	3.1	2.5
35.	3.4	2.5	2.8	2.4	3.0	2.4
36.	3.2	2.3	2.7	2.1	2.8	2.0
37.	3.1	2.7	3.0	2.7	2.7	2.2
38.	3.3	2.7	3.0	2.6	2.9	2.6
39.	3.4	2.5	3.0	2.4	3.3	2.5
40.	3.3	2.5	3.2	2.6	3.4	2.6
41.	3.3	2.6	3.2	2.6	3.4	2.6
42.	3.3	2.7	3.2	3.0	3.5	3.2
43.	2.8	2.3	3.0	2.6	3.2	2.8
44.	2.4	2.2	2.8	2.4	2.8	2.6
45.	3.4	2.6	3.0	2.6	3.2	2.8
46.	3.2	2.8	2.8	2.5	3.2	2.8
47.	3.0	2.7	3.0	2.8	3.2	3.2
48.	2.5	2.3	2.5	2.5	3.2	2.9
49.	2.4	2.1	2.5	2.2	3.0	2.8
Overall mean score for abilities	3.1	2.5	2.9	2.5	3.1	2.7
Total overall mean score	3.1	2.5	3.0	2.6	3.2	2.7

The 31 or more years experience group had the highest overall competence possessed mean score (2.8), with the 16 to 30 years group intermediate (2.7), and the 1 to 15 years experience group having the least competence possessed (2.5). Differences between the overall competence needed and possessed mean scores for abilities were 0.6, 0.4 and 0.4 respectively for the groups with 1 to 15, 16 to 30, and 31 or more years of experience in the seed business.

The overall competence needed mean score for understandings was highest for the 1 to 15 year (3.1) and 31 or more years groups (3.1). The group with 16 to 30 years of experience in the seed business had the lowest overall needed mean score for understandings (2.9).

Widest difference between the mean scores for competence needed and possessed in understandings was for the 1 to 15 years group (0.6). The other groups had a small difference between the competence needed and possessed overall mean scores of 0.4.

Managers and sales personnel with 31 or more years of experience had the highest overall competence needed and possessed scores, whereas the employees with 1 to 15 years of experience had the lowest overall competence needed and possessed scores.

The mean score difference for the 1 to 15 years of experience group for both abilities and understandings indicates a need for expanded educational programs for this experience group. The differences between competence needed and competence possessed mean scores decreased as the years of employment increased for managers and sales personnel.

Competence needed and possessed by production and processing personnel in seed production and distribution businesses stratified by years experience in seed business are included in Table 10.

The overall mean score for competence in abilities needed by production and processing personnel follow a trend. The 1 to 15 years of seed experience group had the lowest competence needed score of 2.8, the 16 to

Table 10. Competencies needed and possessed by production and processing personnel in seed production and distribution by years experience in seed business

Competencies	Mean scores					
	N = 41 1-15 years		N = 34 16-30 years		N = 5 31 or more years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.6	2.1	2.7	1.9	3.4	2.6
2.	2.8	2.3	3.0	2.4	3.6	2.8
3.	2.9	1.9	2.9	2.1	4.0	2.6
4.	2.7	1.8	2.9	2.0	3.8	3.0
5.	2.8	2.3	3.3	2.3	3.8	3.0
6.	3.0	2.5	3.2	2.9	3.6	3.0
7.	2.8	2.5	3.1	2.8	3.8	3.2
8.	3.1	2.5	3.5	3.0	3.2	2.8
9.	2.9	2.4	3.3	2.8	3.6	3.2
10.	3.2	2.6	3.2	2.7	3.8	2.8
11.	3.3	2.6	3.1	2.8	3.0	2.4
12.	3.3	2.6	3.4	3.1	3.4	2.4
13.	2.9	2.3	3.0	2.7	3.8	3.0
14.	2.7	2.3	3.0	2.8	3.0	2.6
15.	2.3	1.7	2.8	2.3	3.0	2.8
16.	2.7	2.0	2.9	2.2	3.6	3.0
17.	2.1	1.8	2.4	1.8	2.8	2.4
18.	2.6	2.2	2.4	2.5	3.2	3.0
19.	3.2	2.4	3.1	2.4	3.2	2.4
20.	2.8	2.4	2.9	2.6	3.2	2.4
21.	3.0	2.5	3.3	2.8	3.6	2.8
22.	2.4	1.7	2.7	2.0	3.2	2.8
23.	1.9	1.4	2.2	1.6	3.4	3.0
24.	3.2	2.6	3.4	2.8	3.4	2.8
25.	2.9	2.4	3.2	3.0	3.8	3.0
26.	2.9	2.1	3.1	2.7	3.2	2.4
27.	2.9	2.4	2.9	2.5	3.4	2.6
28.	2.1	2.1	2.6	2.3	2.8	2.4
Overall mean score for abilities	2.8	2.2	3.0	2.5	3.4	2.8

Table 10 (Continued)

Competencies	Mean scores					
	N = 41		N = 34		N = 5	
	1-15 years		16-30 years		31 or more years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	2.7	2.0	2.8	2.1	3.4	2.8
30.	2.9	2.0	2.8	2.4	3.2	2.8
31.	2.6	1.7	2.5	1.4	3.0	3.2
32.	3.2	2.3	3.3	2.7	3.4	2.8
33.	2.8	1.8	3.1	2.3	3.2	2.4
34.	2.4	1.7	2.6	1.9	2.8	2.8
35.	2.3	1.6	2.6	1.9	3.0	2.4
36.	2.8	1.7	3.0	1.8	2.8	1.6
37.	2.8	1.9	2.8	2.1	3.2	2.6
38.	2.6	1.7	2.9	2.2	3.2	2.6
39.	2.6	1.5	2.4	1.7	3.6	2.6
40.	2.4	1.7	2.5	1.7	3.8	2.4
41.	2.5	1.5	2.6	1.6	3.6	2.8
42.	3.0	2.5	3.2	2.7	3.6	3.0
43.	2.8	2.1	3.2	2.3	3.0	2.2
44.	2.6	2.0	2.6	2.1	2.4	1.8
45.	3.2	2.5	3.2	2.5	3.4	2.6
46.	3.0	2.7	2.0	2.6	3.2	2.4
47.	3.1	2.4	3.3	2.7	3.8	3.4
48.	2.8	2.5	2.9	2.7	2.8	2.6
49.	2.9	2.5	2.8	2.6	3.0	2.6
Overall mean score for understandings	2.8	2.0	2.8	2.2	3.2	2.6
Total overall mean score	2.8	2.1	2.9	2.4	3.3	2.7

30 years of seed experience group had the intermediate competence needed score of 3.0, and the 31 and more years of seed experience group had the highest competence needed score of 3.4.

The overall mean scores for competence in abilities possessed by production and processing personnel followed the same trend as abilities needed. The 1 to 15 years of seed experience group had the lowest competence possessed score of 2.2, the 16 to 30 years of seed experience group had an intermediate score of 2.5, and the 31 and more years of seed experience group had the highest competence possessed score of 2.8.

A difference of 0.6 was found between overall competence scores for abilities needed and possessed for both the 1 to 15 years and the 31 or more years of experience groups. The 16 to 30 years of experience group had a difference of 0.5.

The overall competence needed mean score for understandings for the group with 31 or more years of seed experience was high (3.2). Both of the other groups had scores of 2.8. The mean scores for understandings possessed by production and processing personnel followed the same trend as competence in abilities. The 1 to 15 years of seed experience group had the lowest score of 2.0, the 16 to 30 years of seed experience group had the intermediate score of 2.2, whereas the 31 or more years of seed experience group had the highest competence possessed score of 2.6.

A difference of 0.8 was found between the overall scores for competence in understandings needed and possessed by the 1 to 15 years experience group. Each of the other experience groups had a difference of 0.6.

Production and processing personnel had higher competence needed and possessed scores for both understandings and abilities as the years of experience increased.

The mean score difference for the 1 to 15 years experience group for understandings indicated a special need for continuing education programs for this particular group. Educational programs should be specific enough in content to give individuals sufficient understandings and abilities for successful job entry and advancement.

Table 11 includes mean scores for competence needed and possessed by managers and sales personnel in seed production and distribution firms by number of years of vocational agriculture completed.

The groups with 1 to 3 years and 4 or more years of vocational agriculture had the highest competence needed scores for abilities (3.2), whereas the no vocational agriculture group was low (3.0). The no vocational agriculture and 1 to 3 years groups had the highest competence possessed scores for abilities (2.7), whereas the 4 or more years group was slightly lower (2.6).

Differences between overall abilities needed and possessed mean scores were largest for the four years of vocational agriculture group (0.6), and lowest for no vocational agriculture group (0.3).

The three groups of managers and sales personnel had identical competence needed mean scores for understandings of 3.0.

The one to three years of vocational agriculture group had the most competence possessed in understandings (2.6), with the other groups slightly lower (2.5).

Differences between overall mean scores for understandings needed and possessed were largest for the no vocational agriculture and four years vocational agriculture groups (0.5), whereas the one to three years vocational agriculture group has the smallest difference (0.4).

It was found that all three groups of managers and sales personnel had a high degree of competence needed and possessed. The managers and sales personnel who had completed one to four years of vocational agriculture had

Table 11. Competencies needed and possessed by managers and sales personnel in seed production and distribution by number of years of vocational agriculture completed

Competencies	Mean scores					
	N = 69		N = 24		N = 27	
	None		1-3 years		4 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.7	2.2	3.2	2.4	3.2	2.5
2.	2.9	2.2	3.2	2.1	3.4	2.1
3.	2.2	3.2	2.1	2.4	3.4	2.1
4.	2.9	2.0	3.2	2.4	3.4	2.4
5.	2.9	2.2	3.5	3.0	3.5	2.4
6.	2.8	2.7	3.4	3.3	3.4	3.0
7.	3.0	2.8	3.3	3.2	3.0	2.8
8.	3.3	2.8	3.5	3.0	3.7	2.6
9.	3.3	2.8	3.3	3.0	3.2	2.8
10.	3.2	2.5	3.5	2.7	3.0	2.4
11.	3.0	2.5	3.0	2.8	3.0	2.6
12.	3.4	2.9	3.3	2.8	3.4	2.6
13.	3.0	2.5	3.2	2.8	3.0	2.4
14.	3.2	3.2	3.4	3.1	3.7	3.3
15.	2.9	2.6	3.2	2.7	2.8	2.6
16.	3.4	3.0	3.2	2.9	3.6	3.3
17.	3.2	2.9	3.0	2.5	3.3	3.0
18.	3.0	2.9	2.8	2.7	2.9	2.7
19.	2.8	2.2	3.0	2.0	2.9	2.3
20.	2.7	2.3	2.9	2.4	2.8	2.5
21.	3.2	2.7	3.4	2.9	3.0	2.7
22.	3.0	2.5	3.2	2.8	3.0	2.5
23.	3.0	2.7	3.3	2.8	3.0	2.5
24.	3.6	3.1	3.6	2.8	3.6	3.0
25.	3.5	3.0	3.4	2.7	3.6	2.9
26.	3.4	3.0	3.5	2.7	3.3	2.7
27.	3.4	2.7	3.4	2.8	3.1	2.7
28.	2.8	2.8	2.5	2.2	2.5	2.4
Overall mean score for abilities	3.0	2.7	3.2	2.7	3.2	2.6

Table 11 (Continued)

Competencies	Mean scores					
	N = 69 None		N = 24 1-3 years		N = 27 4 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	3.0	2.4	3.0	2.4	3.0	2.4
30.	2.9	2.7	3.0	2.7	3.3	2.8
31.	2.7	2.1	2.8	2.0	2.6	1.9
32.	3.1	2.2	3.5	2.8	3.4	3.0
33.	3.2	2.7	3.2	2.6	3.1	2.7
34.	2.9	2.4	3.1	2.9	3.0	2.2
35.	2.9	2.4	3.2	2.4	3.0	2.3
36.	2.8	2.2	2.7	2.2	3.0	2.1
37.	2.9	2.6	2.9	2.6	3.1	2.7
38.	3.0	2.7	3.2	2.5	3.4	2.7
39.	3.1	2.4	3.2	2.5	3.1	2.4
40.	3.3	2.6	3.4	2.5	3.2	2.4
41.	3.3	2.7	3.3	2.8	3.1	2.1
42.	3.3	3.0	3.3	3.0	3.1	2.7
43.	2.9	2.4	3.0	2.7	3.3	2.8
44.	2.6	2.3	2.8	2.4	2.9	2.5
45.	3.2	2.7	2.9	2.4	3.3	2.6
46.	3.0	2.8	3.0	2.4	2.9	2.6
47.	3.0	2.8	3.0	2.8	3.1	2.8
48.	2.6	2.5	2.6	2.5	2.6	2.5
49.	2.5	2.3	2.7	2.2	2.4	2.3
Overall mean score for understandings	3.0	2.5	3.0	2.6	3.0	2.5
Total overall mean score	3.0	2.6	3.1	2.6	3.1	2.6

higher competence needed scores for abilities and were identical with the no vocational agriculture group in need for understandings.

For managers and sales personnel, the number of years of vocational agriculture training seemed to have little effect on average mean scores. The probable cause is that in the past teachers of vocational agriculture have stressed production agriculture and the teaching of business management was incidental. Business management and sales principles should be included in vocational agriculture programs in training individuals in agricultural occupations.

Included in Table 12 are the competence scores for production and processing personnel in seed production and distribution by the years of vocational agriculture completed. Highest overall competence needed mean score for abilities was for the four years of vocational agriculture group (3.0) with the other groups slightly lower (2.9).

Highest overall competence possessed mean score for abilities was for the 1 to 3 years of vocational agriculture group (2.5), intermediate was the 4 years of vocational agriculture group (2.4), and lowest was the no vocational agriculture group (2.3).

Difference between overall competence needed and possessed mean scores for abilities was largest for the no vocational agriculture and 4 years of vocational agriculture groups (0.6), and lowest for the one to three years of vocational agriculture group (0.4).

The overall degree of competence mean score for understandings needed by production and processing personnel follows the trend of low for no vocational agriculture group to most competence needed by the 4 years of vocational agriculture group. The no vocational agriculture group had the lowest competence needed score for understandings (2.7), intermediate was the 1 to 3 years of vocational agriculture group (2.9), whereas the highest competence needed score was for 4 years of vocational agriculture (3.0).

Table 12. Competencies needed and possessed by production and processing personnel in seed production and distribution by number of years of vocational agriculture completed

Competencies	Mean scores					
	N = 40		N = 22		N = 18	
	None		1-3 years		4 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.6	1.9	2.8	2.4	2.8	2.0
2.	3.0	2.3	2.8	2.5	2.8	2.4
3.	2.8	1.9	3.0	2.2	3.3	1.9
4.	2.8	1.9	2.9	2.2	3.0	1.9
5.	2.9	2.2	3.1	2.6	3.2	2.4
6.	3.0	2.6	3.1	2.8	2.5	2.7
7.	3.0	2.7	2.8	2.7	3.1	2.7
8.	3.3	2.7	3.3	2.9	3.3	2.7
9.	3.2	2.7	3.1	2.6	2.8	2.5
10.	3.3	2.6	3.3	2.8	3.2	2.5
11.	3.2	2.7	3.0	2.7	3.4	2.7
12.	3.3	2.8	3.2	2.6	3.5	2.8
13.	3.0	2.5	2.8	2.5	3.0	2.5
14.	2.9	2.6	2.9	2.6	2.7	2.3
15.	2.7	1.9	2.4	2.2	2.4	2.0
16.	2.7	2.0	2.8	2.3	3.0	2.2
17.	2.2	1.6	2.3	2.0	2.6	2.2
18.	2.5	2.4	2.3	2.2	2.9	2.4
19.	3.0	2.2	3.1	2.7	3.3	2.4
20.	3.0	2.6	2.6	2.3	2.9	2.5
21.	3.2	2.5	3.0	2.6	3.3	2.9
22.	2.4	1.5	2.8	2.4	2.8	2.0
23.	1.9	1.3	2.6	2.0	2.2	1.8
24.	3.3	2.6	3.3	2.8	3.3	2.7
25.	3.4	2.8	2.8	2.7	2.8	2.4
26.	3.2	2.4	2.8	2.4	2.9	2.3
27.	3.0	2.3	3.0	2.5	2.8	2.6
28.	2.4	2.1	2.4	2.2	2.2	2.3
Overall mean score for abilities	2.9	2.3	2.9	2.5	3.0	2.4

Table 12 (Continued)

Competencies	Mean scores					
	N = 40		N = 22		N = 18	
	None		1-3 years		4 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	2.7	2.0	3.1	2.4	2.8	2.2
30.	2.9	2.1	2.9	2.4	3.0	2.2
31.	2.4	1.5	2.9	2.1	2.6	1.6
32.	3.1	2.5	3.4	2.8	3.5	2.3
33.	3.0	2.0	3.0	2.4	2.9	1.8
34.	2.4	1.6	2.4	2.3	2.8	1.8
35.	2.4	1.6	2.5	2.2	2.7	1.7
36.	2.8	1.7	3.0	2.2	3.0	1.5
37.	2.6	1.9	2.9	2.5	3.1	1.8
38.	2.6	1.8	2.7	2.4	3.0	2.0
39.	2.2	1.3	2.9	2.3	3.0	1.6
40.	2.3	1.6	2.7	2.2	2.8	1.6
41.	2.4	1.3	2.7	2.2	2.9	1.6
42.	3.0	2.5	3.2	2.9	3.3	2.5
43.	2.9	2.0	3.0	2.3	3.0	2.5
44.	2.4	1.8	2.5	2.2	3.0	2.3
45.	3.1	2.4	3.2	2.6	3.4	2.6
46.	3.1	2.8	2.8	2.5	2.1	2.4
47.	3.2	2.5	3.0	2.8	3.7	2.6
48.	2.9	2.6	2.7	2.6	3.0	2.6
49.	2.9	2.5	2.9	2.6	3.1	2.6
Overall mean score for understandings	2.7	2.0	2.9	2.4	3.0	2.1
Total overall mean score	2.8	2.2	2.9	2.4	3.0	2.3

Highest overall mean score for understandings possessed was for the one to three years of vocational agriculture group (2.4), intermediate for the 4 years of vocational agriculture group (2.1), and lowest was for the no vocational agriculture group (2.0).

Difference between overall competence needed and possessed mean scores for understandings was largest for the four years of vocational agriculture group (0.9), intermediate for no vocational agriculture group (0.7), and lowest for one to three years of vocational agriculture (0.5).

The no vocational agriculture group had less competence needed and possessed for both abilities and understandings than those production and processing individuals who had completed one to four years of vocational agriculture.

The recognition of the greatest need for more competence in understandings of seed production and distribution by the individuals who had completed four years of vocational agriculture is perhaps related to the previous training in agronomic principles in vocational agriculture. The awareness of the need for increased competence in seed production and distribution is related to the largest differences between competence needed and possessed scores (0.9) for understandings.

Production agriculture as taught by vocational agriculture instructors appears to be a valid program for teaching scientific and practical principles in seed production. Present instructional programs should be evaluated and new programs should be organized realistically in terms of the findings of this study to meet the needs of seed industry employees.

Mean scores for competence needed and possessed by managers and sales personnel in seed production and distribution classified by educational attainment are presented in Table 13.

The mean scores for competence needed in abilities increased as the years of formal education increased. Personnel with less than 12 years of formal education had the lowest overall degree of competence needed mean

Table 13. Competencies needed and possessed by managers and sales personnel in seed production and distribution by educational attainment

Competencies	Mean scores					
	N = 4		N = 43		N = 73	
	Less than 12 years		12 years		More than 12 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.7	2.2	3.2	2.4	2.7	2.3
2.	2.7	2.0	3.1	2.8	3.0	2.5
3.	3.7	2.7	2.9	2.0	3.1	2.2
4.	2.7	1.7	3.0	2.0	3.2	2.2
5.	3.2	1.7	3.0	2.3	3.3	2.5
6.	2.5	2.2	3.0	2.7	3.2	3.0
7.	2.5	2.0	3.1	2.9	3.1	2.9
8.	2.7	2.2	3.3	2.6	3.5	3.0
9.	3.7	1.5	3.2	2.7	3.3	3.0
10.	3.0	2.0	3.2	2.6	3.3	2.5
11.	2.7	1.5	3.0	2.7	3.0	2.6
12.	2.5	2.0	3.3	2.6	3.5	3.0
13.	3.2	2.2	3.1	2.3	3.0	2.7
14.	2.7	2.2	3.3	3.1	3.4	3.3
15.	3.2	2.5	2.8	2.5	3.0	2.7
16.	2.5	2.2	3.5	3.2	3.4	3.0
17.	3.0	2.2	3.2	2.9	3.2	2.8
18.	2.0	2.2	2.9	2.9	3.0	2.8
19.	3.2	1.5	2.8	2.3	2.9	2.1
20.	2.2	1.5	2.8	2.4	2.8	2.4
21.	2.7	2.5	3.1	2.7	3.3	2.8
22.	3.2	2.5	3.0	2.6	3.1	2.5
23.	3.5	2.7	3.0	2.7	3.1	2.7
24.	3.7	3.0	3.3	2.9	3.7	3.0
25.	3.2	1.7	3.3	2.9	3.6	3.0
26.	3.0	2.7	3.2	2.8	3.6	2.9
27.	3.2	2.2	3.0	2.6	3.5	2.9
28.	2.0	2.7	2.5	2.5	2.8	2.6
Overall mean score for abilities	2.9	2.1	3.1	2.6	3.2	2.7

Table 13 (Continued)

Competencies	Mean scores					
	N = 4 Less than 12 years		N = 43 12 years		N = 73 More than 12 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	3.2	1.7	2.7	2.1	3.1	2.6
30.	3.5	2.7	2.9	2.6	3.0	2.8
31.	3.2	2.0	2.5	1.9	2.8	2.1
32.	2.7	2.2	3.0	2.7	3.4	3.0
33.	3.5	2.2	2.9	2.6	3.3	2.8
34.	3.2	2.7	2.9	2.5	2.9	2.4
35.	3.7	2.5	2.8	2.2	3.1	2.5
36.	3.5	2.5	2.6	2.0	2.9	2.2
37.	3.2	2.2	2.7	2.3	3.1	2.8
38.	3.7	2.5	3.0	2.4	3.2	2.8
39.	3.2	2.5	3.1	2.3	3.1	2.5
40.	3.5	2.0	3.5	2.7	3.2	2.6
41.	3.7	2.2	3.4	2.8	3.2	2.5
42.	3.0	2.5	3.1	2.7	3.4	3.1
43.	2.2	1.0	2.9	2.5	3.1	2.7
44.	2.5	2.2	2.6	2.2	2.7	2.5
45.	3.2	2.2	3.1	2.4	3.2	2.8
46.	2.5	2.5	2.9	2.6	3.0	2.7
47.	2.5	2.7	2.8	2.6	3.1	3.0
48.	2.2	2.0	2.6	2.4	2.7	2.6
49.	2.5	2.5	2.2	2.1	2.7	2.3
Overall mean score for understandings	3.0	2.3	2.9	2.4	3.1	2.6
Total overall mean score	2.9	2.2	3.0	2.5	3.1	2.7

score for abilities (2.9), intermediate were the employees with 12 years of formal education (3.1), whereas those with more than 12 years of formal education had the highest score (3.2).

Competence possessed by managers and sales personnel followed the same trend as competence needed. Managers and sales personnel with less than 12 years of formal education had the lowest overall competence possessed mean score for abilities (2.1), intermediate were the employees with 12 years of formal education (2.6), whereas managers and sales personnel with more than 12 years of formal education had the highest score (2.7).

Largest difference between overall competence needed and possessed mean scores for abilities was for the less than 12 years group (0.8), and smallest was for both of the other groups with more education (0.5).

The more than 12 years of formal education group had the highest overall competence needed mean score for understandings (3.1), intermediate was less than 12 years of formal education group (3.0), and slightly lower was the 12 years of formal education group (2.9).

Managers and sales personnel with less than 12 years of formal education had the lowest overall competence needed mean score for understandings (2.3), intermediate were the employees with 12 years of formal education (2.4), whereas the managers and sales personnel with more than 12 years of formal education had the highest competence possessed score (2.6).

Largest difference between overall competence needed and possessed mean scores was for the less than 12 years group (0.7), and least for the other two groups with more education (0.5).

Managers and sales personnel with increased formal education had greater need for competence in seed production and distribution than those managers and sales personnel with less education. Overall degree of competence possessed by managers and sales personnel was higher with increased formal education. The differences between the overall mean scores for competence needed and possessed in understanding were less for managers and sales personnel with increased formal education.

Competencies needed and possessed by production and processing personnel in seed production and distribution grouped by educational attainment are presented in Table 14.

Production and processing personnel with 12 years, and more than 12 years of formal education had the highest competence needed mean scores for abilities (2.9), whereas those with less than 12 years of formal education had the lowest score (2.7). The overall mean scores for competence possessed in abilities increased as the years of formal education increased. Production and processing personnel with less than 12 years of formal education had the lowest overall competence possessed mean score for abilities (2.2), intermediate were the employees with 12 years of formal education (2.3), whereas those with more than 12 years of formal education had the highest competence possessed score (2.6).

The largest difference between overall competence needed and possessed mean scores for abilities was for the 12 years of education group (0.6), intermediate was for the less than 12 years group (0.5), and least was for the more than 12 years of formal education group (0.3).

The 12 years of formal education group had the highest overall competence needed mean score for understandings (2.9), intermediate was the 12 years group (2.8), and the lowest was the less than 12 years of formal education group (2.5).

Production and processing personnel with increased formal education had greater competence possessed in understandings. Employees with less than 12 years of formal education had the lowest overall competence possessed mean score for understandings (1.8), intermediate was the 12 years

Table 14. Competencies needed and possessed by production and processing personnel in seed production and distribution by educational attainment

Competencies	Mean scores					
	N = 9		N = 45		N = 26	
	Less than 12 years		12 years		More than 12 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.7	1.9	2.8	2.1	2.5	2.0
2.	3.0	1.9	3.0	2.4	2.6	2.5
3.	2.7	1.7	3.0	2.0	3.0	2.0
4.	2.8	1.8	2.9	1.9	2.9	2.1
5.	2.7	2.0	3.1	2.1	3.1	2.9
6.	2.7	2.5	3.1	2.4	3.3	3.2
7.	2.7	2.4	2.9	2.5	3.1	3.0
8.	3.0	2.8	3.2	2.4	3.5	3.3
9.	2.9	2.8	3.1	2.4	3.2	2.9
10.	3.1	2.8	3.3	2.5	3.3	2.8
11.	2.9	2.7	3.3	2.4	3.1	3.1
12.	3.2	3.0	3.3	2.6	3.4	2.9
13.	3.0	2.9	3.0	2.4	2.9	2.7
14.	2.7	2.3	2.8	2.4	3.0	2.9
15.	2.5	1.7	2.6	1.9	2.5	2.3
16.	2.7	1.9	2.9	2.1	2.8	2.4
17.	2.1	1.1	2.6	1.9	1.8	2.0
18.	2.9	2.3	2.5	2.4	2.4	2.3
19.	3.0	2.5	3.3	2.3	2.9	2.5
20.	3.0	2.8	2.9	2.5	2.8	2.4
21.	3.3	2.4	3.3	2.6	3.0	2.4
22.	2.4	1.2	2.6	1.8	2.5	2.3
23.	2.0	1.2	2.4	1.8	1.8	1.5
24.	3.3	2.5	3.3	2.6	3.3	2.9
25.	3.4	2.7	3.0	2.6	3.6	3.2
26.	3.2	2.2	3.0	2.3	3.1	2.6
27.	2.8	2.0	3.0	2.4	3.0	2.7
28.	2.8	2.2	2.4	2.2	2.2	2.3
Overall mean score for abilities	2.7	2.2	2.9	2.3	2.9	2.6

Table 14 (Continued)

Competencies	Mean scores					
	N = 9		N = 45		N = 26	
	Less than 12 years		12 years		More than 12 years	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	2.7	1.7	2.8	2.0	2.9	2.6
30.	2.3	1.4	3.2	2.3	2.5	2.2
31.	2.2	1.1	2.7	1.7	2.5	1.9
32.	2.9	2.0	3.4	2.4	3.2	3.0
33.	2.7	1.7	3.1	2.0	2.9	2.3
34.	2.3	1.2	2.5	1.8	2.6	2.1
35.	2.3	1.7	2.5	1.6	2.5	2.0
36.	2.8	1.8	2.9	1.6	2.9	2.0
37.	2.1	1.3	2.7	1.8	3.2	2.6
38.	2.2	1.3	2.8	1.9	2.8	2.4
39.	2.1	0.9	2.7	1.6	2.5	1.9
40.	2.7	1.2	2.7	1.7	2.4	2.0
41.	2.5	1.4	2.7	1.6	2.5	1.7
42.	2.7	2.1	3.2	2.5	3.2	3.0
43.	2.7	1.4	3.0	2.1	3.1	2.6
44.	2.4	1.5	2.6	2.1	2.5	2.2
45.	3.3	2.8	3.2	2.4	3.1	2.7
46.	3.2	3.1	3.0	2.5	3.1	2.7
47.	3.0	2.2	3.2	2.4	3.4	3.0
48.	3.1	2.9	2.9	2.5	2.6	2.7
49.	3.0	2.5	3.0	2.6	2.7	2.5
Overall mean score for understandings	2.5	1.8	2.9	2.1	2.8	2.4
Total overall mean score	2.6	2.0	2.9	2.2	2.9	2.5

of formal education group (2.1), whereas the production and processing personnel with more than 12 years of formal education had the highest competence possessed score (2.4).

Largest difference between overall mean scores for competence needed and possessed in understandings was for the 12 years group (0.8), intermediate for the less than 12 years group (0.7), and smallest was for the more than 12 years of formal education group (0.4).

Production and processing personnel with increasing education had both more competence needed and possessed in seed production and distribution than personnel with less education. Educational institutions should continue and expand existing educational programs designed to develop understandings, skills and abilities needed by workers in the seed industry.

Competencies needed and possessed by managers and sales personnel in seed production and distribution stratified by age are presented in Table 15. The highest competence needed overall mean score for abilities was 3.2 for both the youngest (less than 40 years) and oldest (56 years and over) managers and sales personnel.

The youngest group (less than 40 years) had the highest overall competence possessed mean score for abilities (2.7), with the two older groups having a slightly lower score (2.6).

The difference between the overall competence needed and possessed mean scores for abilities for managers and sales personnel ranged from 0.5, 0.5 and 0.6 respectively for the groups less than 40 years, 41 to 55 years, and 56 years and over in age.

The overall competence needed mean score for understandings was highest for both the youngest (less than 40 years) and the oldest (56 years and over) managers and sales personnel (3.1) and lowest (2.8) for the middle age group (41 to 55 years).

The youngest group (less than 40 years) had the highest overall compe-

Table 15. Competencies needed and possessed by managers sales personnel in seed production and distribution by their present age

Competencies	Mean scores					
	N = 36		N = 53		N = 31	
	Less than 40 years		41-55 years		56 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.8	2.2	3.0	2.4	2.8	2.4
2.	3.0	2.6	3.1	2.7	2.7	2.2
3.	3.2	2.3	2.9	2.0	3.2	2.2
4.	3.2	2.4	2.9	2.1	3.2	2.0
5.	3.1	2.5	3.1	2.5	3.4	2.2
6.	2.8	2.8	3.2	2.9	3.3	2.8
7.	3.0	2.7	3.1	3.0	3.2	2.8
8.	3.5	2.8	3.3	2.9	3.5	2.8
9.	3.3	2.8	3.3	2.9	3.5	2.8
10.	3.2	2.3	3.2	2.7	3.3	2.4
11.	3.0	2.6	2.9	2.6	3.2	2.6
12.	3.2	2.7	3.5	2.9	3.4	2.8
13.	3.0	2.5	2.8	2.5	3.3	2.7
14.	3.2	3.2	3.4	3.3	3.3	3.1
15.	3.0	2.9	3.0	2.6	2.9	2.3
16.	3.5	3.2	3.3	3.1	3.4	2.8
17.	3.4	3.0	3.2	2.7	3.1	2.8
18.	3.0	2.9	2.8	2.9	3.0	2.5
19.	2.9	2.1	2.7	2.1	3.0	2.3
20.	2.8	2.6	2.7	2.3	2.9	2.2
21.	3.4	2.9	3.1	2.7	3.1	2.6
22.	3.3	2.5	2.9	2.6	3.1	2.6
23.	3.2	2.8	3.0	2.6	3.0	2.7
24.	3.7	3.0	3.4	3.0	3.7	3.0
25.	3.7	3.0	3.4	2.8	3.5	2.9
26.	3.5	2.9	3.4	2.8	3.3	3.0
27.	3.5	2.9	3.2	2.7	3.4	2.6
28.	2.8	2.7	2.5	2.4	2.8	2.6
Overall mean score for abilities	3.2	2.7	3.1	2.6	3.2	2.6

Table 15 (Continued)

Competencies	Mean scores					
	N = 36		N = 53		N = 31	
	Less than 40 years		41-55 years		56 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	3.1	2.5	2.8	2.3	3.1	2.4
30.	2.9	2.8	3.1	2.8	2.9	2.4
31.	3.0	2.3	2.5	1.9	2.8	2.2
32.	3.3	3.0	3.2	2.9	3.3	2.7
33.	3.2	2.8	3.0	2.6	3.3	2.8
34.	3.1	2.5	2.8	2.4	3.0	2.5
35.	3.3	2.6	2.8	2.3	3.1	2.3
36.	3.2	2.4	2.6	2.1	2.8	2.0
37.	3.3	2.8	2.8	2.5	2.9	2.5
38.	3.4	2.8	2.9	2.4	3.1	2.8
39.	3.5	2.6	2.9	2.4	3.1	2.4
40.	3.5	2.6	3.2	2.7	3.3	2.4
41.	3.4	2.6	3.3	2.7	3.1	2.5
42.	3.2	2.8	3.1	3.0	3.5	3.0
43.	3.0	2.6	2.9	2.6	3.1	2.5
44.	2.6	2.3	2.6	2.3	3.0	2.5
45.	3.5	2.7	2.9	2.5	3.1	2.7
46.	3.0	2.8	2.8	2.6	3.2	2.6
47.	3.0	2.8	3.0	2.7	3.2	3.0
48.	2.6	2.5	2.3	2.4	3.1	2.8
49.	2.5	2.3	2.4	2.1	2.7	2.5
Overall mean score for understanding	3.1	2.6	2.8	2.5	3.1	2.5
Total overall mean score	3.2	2.7	2.9	2.6	3.1	2.5

tence possessed mean score for understandings (2.6), with the two older groups having slightly lower scores (2.5).

Widest differences between competence needed and possessed overall mean scores for understandings were for the oldest age group (56 and over), (0.6), intermediate for the youngest group (0.5), and least for the middle age group (0.3).

Managers and sales personnel tended to possess less competence as they grew older. The youngest group had the highest total overall mean score for competence possessed (2.7), followed by 2.6 for the middle age group who were 41 to 55 years old, and 2.5 for the oldest group, 56 years and over.

Educational programs should be developed for managers and sales personnel to increase their efficiency and opportunity for job advancement in the seed industry. The 49 competencies have importance in planning educational programs and they should form the basis for seed production and distribution instruction in (1) vocational agriculture day classes, young and adult farmer classes; (2) cooperative agriculture extension programs; (3) area vocational technical schools; and in (4) industry in-service training programs.

Competencies needed and possessed by production and processing personnel in seed production and distribution classified by age are presented in Table 16.

The highest competence needed overall mean score for abilities was 2.9 for both the youngest (less than 40) and middle age (41 to 55 years of age) groups, and slightly lower (2.8) for the oldest age group (56 years and over).

The production and processing personnel tended to possess more competence as they grew older. The youngest group had the lowest competence possessed mean score for abilities (2.3), the middle age group had an

Table 16. Competencies needed and possessed by production and processing personnel in seed production and distribution by their present age

Competencies	Mean scores					
	N = 41		N = 30		N = 9	
	Less than 40 years		41-55 years		56 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.7	2.0	2.6	2.1	2.8	2.3
2.	2.8	2.3	3.0	2.4	2.9	2.7
3.	3.1	2.0	2.8	2.0	2.5	2.0
4.	3.0	1.9	2.8	1.9	2.8	2.2
5.	2.9	2.4	3.1	2.4	3.4	2.3
6.	3.2	2.6	3.1	2.8	3.1	3.0
7.	3.0	2.7	3.0	2.7	2.4	2.5
8.	3.3	2.6	3.3	2.8	3.4	3.2
9.	3.0	2.5	3.3	2.8	3.1	2.8
10.	3.3	2.6	3.3	2.7	3.3	2.5
11.	3.3	2.7	3.2	2.8	2.8	2.7
12.	3.2	2.6	3.5	2.9	3.3	3.1
13.	2.9	2.3	3.1	2.7	3.0	2.9
14.	2.8	2.5	2.9	2.5	3.2	2.8
15.	2.5	2.0	2.8	2.1	1.9	1.8
16.	2.8	2.3	2.7	2.0	3.1	2.4
17.	2.4	2.0	2.1	1.6	2.5	2.0
18.	2.6	2.3	2.6	2.4	2.2	2.4
19.	3.2	2.4	3.0	2.4	3.0	2.7
20.	2.8	2.4	3.0	2.5	2.8	2.5
21.	3.1	2.7	3.4	2.6	3.0	2.4
22.	2.7	1.8	2.4	1.8	2.5	2.4
23.	2.2	1.6	1.9	1.4	2.8	2.2
24.	3.3	2.7	3.3	2.6	3.2	2.9
25.	2.9	2.5	3.4	2.8	3.3	3.1
26.	3.0	2.3	3.1	2.4	2.8	2.5
27.	3.0	2.6	2.9	2.3	2.8	2.2
28.	2.4	2.4	2.3	2.0	2.7	1.9
Overall mean score for abilities	2.9	2.3	2.9	2.4	2.8	2.5

Table 16 (Continued)

Competencies	Mean scores					
	N = 41		N = 30		N = 9	
	Less than 40 years		41-55 years		56 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	2.9	2.3	2.6	2.0	2.9	2.0
30.	3.1	2.2	2.7	2.2	2.8	2.2
31.	2.8	1.9	2.2	1.3	2.9	1.9
32.	3.5	2.6	3.0	2.3	3.1	2.9
33.	3.1	1.9	2.9	2.2	2.7	2.3
34.	2.6	1.8	2.2	1.7	3.0	2.5
35.	2.5	1.7	2.4	1.6	2.7	2.3
36.	3.0	1.9	2.8	1.7	2.7	1.5
37.	3.0	2.0	2.5	1.9	3.0	2.4
38.	2.9	2.0	2.5	2.0	2.9	2.2
39.	2.7	1.6	2.4	1.6	2.4	1.8
40.	2.6	1.8	2.3	1.7	3.0	1.7
41.	2.7	1.6	2.4	1.5	3.1	1.9
42.	3.2	2.5	3.0	2.7	3.3	2.8
43.	3.1	2.3	2.6	2.1	3.3	2.1
44.	2.7	2.1	2.4	1.9	2.5	2.4
45.	3.2	2.5	3.1	2.4	3.3	2.8
46.	3.0	2.6	3.2	2.9	2.7	2.1
47.	3.3	2.5	3.2	2.7	3.2	2.9
48.	2.8	2.4	3.0	2.7	2.4	3.1
49.	2.9	2.5	3.1	2.6	2.3	2.4
Overall mean score for understandings	2.8	2.1	2.7	2.0	2.9	2.3
Total overall mean score	2.9	2.2	2.8	2.2	2.9	2.4

intermediate mean score for abilities (2.4), whereas the oldest group had the highest competence possessed score (2.5).

The difference between the overall competence needed and possessed mean scores for abilities tended to decrease with age. They ranged from 0.6, 0.5, and 0.3 respectively for the youngest (less than 40), middle age (41 to 55) and oldest (56 years and over) groups.

The oldest group had the highest overall competence needed mean score for understandings (2.9), intermediate was the youngest age group (2.8), and lowest was the middle age group (2.7). The oldest group had the highest overall competence possessed mean score for understandings (2.3), intermediate was the youngest age group (2.1), and lowest was the middle age group (2.0).

Widest differences between competence needed and possessed overall mean scores for understandings were for the two youngest groups (0.7), and least for the oldest age group (0.6).

The three age group production and processing personnel tended to need the same degree of competence in the competencies studied. However, the employees tended to possess more competence as they grew older.

Scores for competence needed and possessed by managers and sales personnel in seed production and distribution stratified by the number of years lived on a farm after age 12 are included in Table 17.

The number of years that managers and sales personnel lived on a farm had little influence on the abilities needed. The 31 years and over group had the highest competence needed score of 3.2, whereas the other two groups (0 to 5 years and 6 to 30 years) had slightly lower competence scores (3.1).

The 6 to 30 years group had the highest competence possessed mean score (2.7), whereas the other two groups (0 to 5 years and 31 years and over) had slightly lower competence scores (2.6).

Table 17. Competencies needed and possessed by managers and sales personnel in seed production and distribution by the number of years lived on a farm after age 12

	Mean scores					
	N = 46		N = 57		N = 17	
Competencies	0-5 years		6-30 years		31 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.7	2.2	3.0	2.5	3.1	2.3
2.	2.8	2.4	3.2	2.7	2.9	2.3
3.	2.9	2.0	3.2	2.2	3.1	2.3
4.	2.9	1.9	3.2	2.3	3.3	2.3
5.	2.8	2.2	3.5	2.6	3.1	2.3
6.	3.0	2.7	3.2	3.0	3.2	3.0
7.	2.9	2.6	3.1	3.0	3.4	3.1
8.	3.4	2.9	3.4	2.8	3.6	2.8
9.	3.2	2.9	3.2	2.8	3.6	2.9
10.	3.1	2.5	3.2	2.4	3.6	2.7
11.	2.9	2.6	3.0	2.6	3.2	2.7
12.	3.5	3.0	3.4	2.8	3.2	2.4
13.	2.9	2.6	3.0	2.5	3.2	2.8
14.	3.2	3.2	3.5	3.2	3.2	2.9
15.	3.1	2.6	2.8	2.6	3.1	2.6
16.	3.4	3.0	3.4	3.2	3.3	2.7
17.	3.1	2.8	3.3	3.0	3.2	2.4
18.	3.1	2.9	2.8	2.7	2.9	2.7
19.	2.6	2.1	3.0	2.2	3.2	2.2
20.	2.7	2.4	2.8	2.5	2.9	1.9
21.	3.4	2.7	3.1	2.8	3.2	2.5
22.	3.0	2.2	3.0	2.7	3.2	2.8
23.	3.0	2.7	3.9	2.7	3.2	2.9
24.	3.7	2.9	2.6	3.1	3.5	2.9
25.	3.5	3.0	3.5	3.0	3.5	2.4
26.	3.7	3.1	3.3	2.8	3.0	2.5
27.	3.5	2.8	3.2	2.7	3.2	2.5
28.	3.0	2.8	2.6	2.5	2.2	2.2
Overall mean score for abilities	3.1	2.6	3.1	2.7	3.2	2.6

Table 17 (Continued)

Competencies	Mean scores					
	N = 46		N = 57		N = 17	
	0-5 years		6-30 years		31 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	3.0	2.4	3.0	2.4	3.9	2.5
30.	2.7	2.6	3.1	2.8	3.3	3.0
31.	2.8	2.0	2.7	2.0	2.8	2.6
32.	3.2	2.8	3.3	3.0	3.3	2.6
33.	3.2	2.7	3.2	2.8	3.1	2.5
34.	3.1	2.5	2.9	2.5	2.8	2.5
35.	3.1	2.4	3.0	2.5	3.0	2.2
36.	2.7	2.0	3.0	2.3	2.6	2.1
37.	2.7	2.5	3.2	2.7	2.8	2.5
38.	2.8	2.5	3.4	2.8	3.1	2.5
39.	2.9	2.3	3.2	2.5	3.2	2.6
40.	3.3	2.7	3.3	2.6	3.2	2.2
41.	3.3	2.7	3.2	2.6	3.2	2.5
42.	3.3	3.0	3.2	2.9	3.4	2.9
43.	2.9	2.3	3.1	2.9	2.8	2.4
44.	2.6	2.1	2.7	2.6	2.8	2.4
45.	3.0	2.6	3.2	2.7	3.2	2.6
46.	3.0	2.7	2.9	2.6	3.2	2.7
47.	2.9	2.6	3.1	2.9	3.1	3.1
48.	2.5	2.3	2.7	2.6	2.7	2.6
49.	2.4	2.0	2.6	2.4	2.8	2.6
Overall mean score for understandings	2.9	2.5	3.0	2.6	3.0	2.6
Total overall mean score	3.0	2.5	3.1	2.7	3.1	2.6

The overall mean scores for competence in understandings needed and possessed by managers and sales personnel followed a slight trend toward more competence with increased years on the farm. The two groups with farm experience had competence needed mean scores of 3.0 and competence possessed mean scores of 2.6, whereas the 0 to 5 years of farm experience group had a slightly lower competence needed mean score of 2.9 and a competence possessed mean score of 2.6.

When the abilities and understandings were combined into the total overall competence needed mean score, a slight pattern toward more competence with increased years on the farm was established. Both of the farm experience groups (6 to 30 years and 31 years and over) had a higher competence needed score (3.1), than the 0 to 5 years of farm experience group (3.0).

The same pattern toward more competence possessed with the number of years on the farm was found with managers and sales personnel. The 6 to 30 years of farm experience group had the highest total competence possessed mean score of 2.7, intermediate was the 31 years and over group (2.6), lowest were the managers and sales personnel with the least farm experience (2.5).

Competencies needed and possessed by production and processing personnel in seed production and distribution grouped by the number of years lived on a farm after age 12 are presented in Table 18.

The 31 years and over farm experience group had the highest competence needed mean score for abilities of 3.2, intermediate was the 6 to 30 years of farm experience group (2.9), and lowest was the least farm experience group (2.8).

The 31 years and over farm experience group had the highest competence possessed mean score for abilities of 2.4, whereas the other two farm experience groups had a competence possessed mean scores of 2.3.

Table 18. Competencies needed and possessed by production and processing personnel in seed production and distribution by the number of years lived on a farm after age 12

Competencies	Mean scores					
	N = 27		N = 47		N = 6	
	0-5 years		6-30 years		31 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Abilities						
1.	2.5	1.6	2.7	2.2	3.2	2.5
2.	2.9	2.2	2.8	2.5	3.5	2.5
3.	2.8	1.8	2.9	2.1	3.8	2.2
4.	2.7	1.6	2.9	2.1	3.5	2.5
5.	2.8	2.1	3.1	2.5	3.7	2.8
6.	3.1	2.7	3.1	2.7	3.5	3.0
7.	2.8	2.5	3.0	2.7	3.7	3.2
8.	3.5	2.7	3.2	2.7	3.5	2.7
9.	3.2	2.6	3.0	2.6	3.5	2.8
10.	3.3	2.5	3.2	2.7	3.7	2.7
11.	3.2	2.7	3.2	2.7	3.3	2.7
12.	3.4	3.1	3.3	2.7	3.5	2.3
13.	2.9	2.4	3.0	2.5	3.7	2.8
14.	2.9	2.7	2.8	2.4	3.4	2.7
15.	2.3	1.8	2.6	2.2	2.8	1.6
16.	2.8	2.2	2.8	2.1	3.3	2.2
17.	2.0	1.5	2.3	2.0	3.3	1.8
18.	2.4	2.5	2.5	2.2	3.0	2.3
19.	3.2	2.3	3.1	2.5	3.2	2.2
20.	3.0	2.6	2.8	2.4	3.0	2.5
21.	3.2	2.7	3.1	2.7	3.5	2.3
22.	2.3	1.3	2.7	2.2	3.2	2.2
23.	1.7	1.2	2.3	1.8	3.0	2.2
24.	3.3	2.8	3.3	2.7	3.3	2.3
25.	3.1	2.8	3.1	2.7	3.7	2.7
26.	3.0	2.5	3.0	2.3	3.3	2.0
27.	2.8	2.4	3.0	2.5	3.3	1.8
28.	2.3	2.3	2.4	2.3	2.0	1.5
Overall mean score for abilities	2.8	2.3	2.9	2.3	3.2	2.4

Table 18 (Continued)

Competencies	Mean scores					
	N = 27 0-5 years		N = 47 6-30 years		N = 6 31 years and over	
	Needed	Possessed	Needed	Possessed	Needed	Possessed
Understandings						
29.	2.4	2.0	3.0	2.2	3.5	2.5
30.	2.8	2.1	2.9	2.2	2.7	2.3
31.	2.3	1.6	2.6	1.7	3.3	2.2
32.	3.2	2.7	3.2	2.4	3.7	2.7
33.	3.0	2.1	2.9	2.0	3.3	2.2
34.	2.3	1.5	2.5	2.0	3.0	2.3
35.	2.3	1.6	2.5	1.9	3.0	1.7
36.	2.8	1.9	2.9	1.7	3.0	1.3
37.	2.5	1.9	2.9	2.1	3.0	1.7
38.	2.4	1.8	2.9	2.1	2.7	1.7
39.	2.0	1.3	2.8	1.9	3.3	1.7
40.	2.0	1.6	2.7	1.9	2.5	1.4
41.	2.3	1.4	2.7	1.7	3.3	1.7
42.	2.9	1.5	3.2	1.7	3.3	2.7
43.	2.8	1.9	3.1	2.4	2.7	1.8
44.	2.2	1.6	2.8	2.3	2.7	2.2
45.	3.2	2.4	3.2	2.6	3.0	2.2
46.	3.2	2.9	2.9	2.5	3.0	2.3
47.	3.4	2.6	3.1	2.6	3.5	3.0
48.	3.0	2.5	2.8	2.7	2.8	2.5
49.	3.0	2.4	2.8	2.6	3.2	2.5
Overall mean score for understandings	2.7	2.0	2.9	2.1	3.0	2.1
Total overall mean score	2.7	2.2	2.9	2.2	3.1	2.2

Widest differences between competence needed and possessed overall mean scores for abilities was found for the 31 years and over of farm experience group (0.8), intermediate with the 6 to 30 years group (0.6), and smallest was for the 0 to 5 years of farm experience group (0.5).

The overall mean scores for competence needed in understandings by production and processing personnel established a trend of more competence with the increased years on the farm. The 0 to 5 years experience group has least competence (2.7), the 6 to 30 years group were intermediate in competence (2.9), whereas the 31 years and over group had the highest competence needed score (3.0). The groups with the most farm experience had higher competence scores for understandings possessed (2.1), whereas the 0 to 5 years farm experience group had a slightly lower competence possessed mean score of 2.0.

The widest differences between competence needed and possessed overall mean scores for understandings was 0.9 for the group with 31 years of farm experience, 0.8 for the group with 6 to 30 years of farm experience, and 0.7 for the group with 0 to 5 years of farm experience.

Correlation Matrices of Selected Variables

Product moment correlation matrices including 18 selected variables are presented in Tables 19 and 20. The selected variables were eight control variables and the degree of competence needed and possessed scores for the five competencies with highest competence needed mean scores. The selected variables included in the two matrices are referred to by number as follows: (1) number of years in seed business, (2) number of years experience at present job, (3) number of years lived on a farm after age 12, (4) age, (5) number of years of vocational agriculture completed, (6) highest grade in school completed, (7) kind of seed activities of the seed company, and (8) type of seed business.

Table 19. Product moment correlation matrix of selected variables for managers and sales personnel in seed production and distribution (.182 is significant at 1 percent level; .237 is significant at 5 percent level with N = 120)[a]

Variables	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.800	1.000							
3	0.108	0.246	1.000						
4	0.705	0.590	0.256	1.000					
5	-0.132	-0.042	0.087	-0.188	1.000				
6	0.151	0.090	-0.136	0.095	0.063	1.000			
7	-0.095	-0.089	-0.097	-0.065	-0.122	-0.308	1.000		
8	0.021	-0.018	-0.105	-0.000	0.003	-0.148	0.448	1.000	
9	0.104	0.101	0.052	-0.049	0.204	0.071	0.008	-0.115	1.000
10	0.070	0.065	-0.044	-0.054	-0.058	0.254	-0.088	-0.200	0.560
11	0.305	0.264	-0.159	0.117	0.024	0.199	-0.100	-0.069	0.329
12	0.145	0.072	-0.232	0.027	-0.132	0.260	-0.108	-0.064	0.017
13	-0.051	-0.062	-0.089	-0.048	-0.043	0.198	-0.004	0.027	0.298
14	0.032	0.072	-0.031	-0.030	0.068	0.074	0.024	0.053	0.080
15	0.055	0.047	-0.085	-0.058	0.046	0.205	-0.033	-0.030	0.436
16	0.119	0.055	-0.224	-0.001	-0.097	0.247	-0.093	0.074	0.104
17	-0.083	-0.131	-0.349	-0.136	-0.097	0.344	0.065	0.022	0.025
18	0.079	-0.006	-0.239	0.057	-0.190	0.183	0.074	0.015	-0.028

[a] Selected variables are numbered as follows: (1) years in seed business, (2) years experience at present job, (3) years lived on a farm after age 12, (4) age, (5) years of vocational agriculture, (6) highest grade in school completed, (7) kind of seed activities, (8) type of seed business, (9) ability needed to use quality control measures to maintain quality of seed, (10) ability possessed to use quality control measures to maintain quality of seed, (11) ability needed to work cooperatively under adverse conditions, (12) ability possessed to work cooperatively under adverse conditions, (13) ability needed to make sound decisions unaided, (14) ability possessed to make sound decisions unaided, (15) ability needed to delegate responsibilities so (footnote continued on following page)

Table 19 (Continued)

Variables	10	11	12	13	14	15	16	17	18
1									
2									
3									
4									
5									
6									
7									
8									
9									
10	1.000								
11	0.225	1.000							
12	0.408	0.531	1.000						
13	0.270	0.254	0.250	1.000					
14	0.152	0.144	0.230	0.347	1.000				
15	0.284	0.377	0.190	0.616	0.220	1.000			
16	0.214	0.393	0.443	0.208	0.420	0.380	1.000		
17	0.178	0.329	0.388	0.508	0.286	0.362	0.305	1.000	
18	0.153	0.249	0.388	0.212	0.445	0.198	0.495	0.463	1.000

(footnote continued from previous page) employee can pursue work expected of him, (16) ability possessed to delegate responsibilities so employee can pursue work expected of him, (17) ability needed to communicate effectively both orally and in writing, (18) ability possessed to communicate effectively both orally and in writing.

Table 20. Product moment correlation matrix of selected variables for production and processing personnel in seed production and distribution (.223 is significant at 1 percent level; .290 is significant at 5 percent level with N = 80)[a]

Variables	1	2	3	4	5	6	7	8	9
1	1.000								
2	0.851	1.000							
3	0.072	0.186	1.000						
4	0.654	0.600	0.251	1.000					
5	-0.200	-0.130	0.057	-0.291	1.000				
6	-0.046	-0.129	-0.076	-0.182	0.194	1.000			
7	0.004	0.099	0.220	0.098	-0.002	-0.125	1.000		
8	-0.135	-0.003	0.055	-0.098	-0.011	-0.047	0.448	1.000	
9	0.285	0.205	0.147	0.039	0.083	0.102	-0.192	-0.160	1.000
10	0.063	-0.048	0.245	-0.097	0.058	0.221	-0.135	-0.181	0.534
11	0.067	0.046	-0.024	0.040	0.131	0.047	-0.062	0.023	0.469
12	0.095	-0.015	-0.300	0.162	-0.046	0.067	-0.150	0.059	0.197
13	0.078	0.030	0.056	-0.166	0.189	-0.039	-0.125	-0.143	0.474
14	0.198	0.058	-0.140	-0.002	-0.061	0.263	-0.217	-0.081	0.301
15	0.141	0.196	0.161	-0.005	0.150	0.059	0.007	-0.054	0.551
16	0.226	0.203	0.118	0.050	-0.007	0.220	-0.120	0.022	0.447
17	0.211	0.144	0.061	-0.084	0.062	0.122	-0.093	-0.093	0.417
18	0.117	0.093	0.106	-0.137	0.154	0.320	-0.277	-0.092	0.344

[a] Selected variables are numbered as follows: (1) years in seed business, (2) years experience at present job, (3) years lived on a farm after age 12, (4) age, (5) years of vocational agriculture, (6) highest grade in school completed, (7) kind of seed activities, (8) type of seed business, (9) ability needed to safely apply and handle agricultural chemicals, (10) ability possessed to safely apply and handle agricultural chemicals, (11) ability needed to work cooperatively under adverse conditions, (12) ability possessed to work cooperatively under adverse conditions, (13) understanding needed of seed viability, purity, and germination, (14) understanding possessed of seed viability, purity, and germination, (15) understanding needed of crop (footnote continued on following page)

Table 20 (Continued)

Variables	10	11	12	13	14	15	16	17	18
1									
2									
3									
4									
5									
6									
7									
8									
9									
10	1.000								
11	0.379	1.000							
12	0.274	0.534	1.000						
13	0.297	0.305	0.072	1.000					
14	0.305	0.177	0.345	0.473	1.000				
15	0.421	0.363	0.217	0.604	0.411	1.000			
16	0.548	0.315	0.368	0.415	0.570	0.635	1.000		
17	0.230	0.194	0.117	0.326	0.223	0.524	0.381	1.000	
18	0.531	0.170	0.248	0.275	0.451	0.385	0.710	0.533	1.000

(footnote ontinued from previous page) maturity and planting dates, (16) understanding possessed of crop maturity and planting dates, (17) understanding needed of soil sampling, fertilizer recommendations and fertilizer selection, (18) understanding possessed of soil sampling, fertilizer recommendations and fertilizer selection.

Variables 9 to 18 in Table 19 for manager and sales personnel are as follows: (9) degree competence needed score for the ability to use quality control measures to maintain quality of seed, (10) degree competence possessed score for the ability to use quality control measures to maintain quality of seed, (11) degree competence needed score for the ability to work cooperatively under adverse conditions, (12) degree competence possessed score for the ability to work cooperatively under adverse conditions, (13) degree competence needed score for the ability to make sound decisions unaided, (14) degree competence possessed score for the ability to make sound decisions unaided, (15) degree competence needed score for the ability to delegate responsibilities so employee can pursue work expected of him, (16) degree competence possessed score for the ability to delegate responsibilities so employee can pursue work expected of him, (17) degree competence needed score for the ability to communicate effectively both orally and in writing, and (18) degree competence possessed score for the ability to communicate effectively both orally and in writing.

According to James E. Wert (22, p. 424) an absolute value of .182 is significant at the five percent level and an absolute value of .237 is significant at the one percent level. Seven correlations among control variables were found to be significant at the one percent level and one at the five percent level. The two highest correlations were between years in seed business and years of experience at present job (.800), and age (.704). Four other correlations significant at the one percent level were years experience at present job and age (.589), years experience at present job and number years lived on a farm after age 12 (.246), number of years lived on a farm after age 12 and age (.255), and kind of seed activities of the seed company and type of seed business (.448). Highest grade in school completed and the kind of seed activities of the seed company were negatively correlated at the one percent level (-.308). Age and the number of years of vocational agriculture completed were negatively correlated at the five percent level (-.188).

Control variables were correlated with degree of competence needed and competence possessed scores for five competencies. Four competence needed scores and four competence possessed scores were significantly correlated at the one percent level with control variables. The competence needed score for the ability to communicate effectively both orally and in writing was significantly correlated with highest grade in school (+.344) and negatively correlated at the one percent level with the number of eyars lived on a farm after age 12 (-.349). The competence needed score for the ability to work cooperatively under adverse conditions was significantly correlated with years in the seed business (+.304) and with years experience on present job (+.263). Three other correlations significant at the one percent level were between the highest grade in school completed and the following possessed abilities: use quality control measures to maintain quality of seed (+.254), work cooperatively under adverse conditions (+.259), and delegate responsibilities so employee can pursue work expected of him (+.246). Number of years lived on a farm after age 12 was correlated negatively with the possessed ability to communicate effectively both orally and in writing (-.239).

Four competence needed scores and five competence possessed scores were correlated significantly at the five percent level with control variables. The highest grade in school completed was correlated at the five percent level with the ability needed to delegate responsibilities so employee can pursue work expected of him (+.205), make sound decisions unaided (+.198), and work cooperatively under adverse conditions (+.199). The number of years of vocational agriculture completed was correlated at the five percent level with the ability needed to use quality control measures to maintain quality of seed (+.203).

The five competence possessed scores that were significantly correlated at the five percent level with variables were divided into two positive and three negative correlations. The highest grade in school completed was correlated with the ability possessed to communicate effectively both orally and in writing (+.183). The type of seed business was correlated with the ability possessed to use quality control measures to maintain quality of the seed (+.200). The three remaining correlations that were significant at the five percent level were negative correlations. They were: number of years lived on a farm after age 12, and (1) the ability possessed to work cooperatively under adverse conditions (-.231), and (2) the ability possessed to delegate responsibilities so employee can pursue work expected of him (-.223). The number of years of vocational agriculture completed and the ability possessed to communicate effectively both orally and in writing were correlated negatively (-.189).

When degree of competence needed scores were correlated with degree of competence possessed scores for the same competency, correlations were significant above the one percent level for all five competencies. The competencies with highest correlations between competence needed and competence possessed scores were the abilities to use quality control measures to maintain quality of seed (+.560) and the ability to work cooperatively under adverse conditions (+.531).

Correlations among degree of competence needed scores resulted in all except one of the ten correlations to be significant at the one percent level. The highest correlation was between the ability to make sound decisions unaided and the ability to delegate responsibilities so employee can pursue work expected of him (+.616).

Correlations among degree of competence possessed scores indicated that eight of the ten correlations were significant at the five percent level or higher level. The highest correlation was between the ability possessed to delegate responsibilities so employee can pursue work expected of him and the ability to communicate effectively both orally and in writing (+.494).

When correlations were run, several relationships were noted. For the managers and sales personnel, years in seed business, years at present job, age, number of years lived on a farm after age 12, kind of seed activities of the seed company, and type of seed business were related. Age and the number of years of vocational agriculture completed were negatively correlated at the five percent level (-.188). This probably occurred because the older men had their education before vocational agriculture was readily available and when high school education received less emphasis.

Vocational agriculture educators should note the significance of the two correlations involving vocational agriculture attendance. The positive correlation with vocational agriculture of the ability needed to use quality control measures to maintain quality of seed (+.203) reflects the emphasis on technical agriculture in vocational agriculture classes. The negative correlation of vocational agriculture with the ability possessed to communicate effectively both orally and in writing (-.189) has implications on curriculum content. The author suggests that this may be due to a lack of emphasis on technical papers and oral reports in agricultural courses. It may indicate that students may take fewer English courses when they enroll in the vocational agriculture curriculum.

Table 20 is a product moment correlation matrix of selected variables for the production and processing personnel. The first eight selected variables were the same variables used in Table 19 for the managers and sales personnel. Variables 9 through 18 in Table 20 for production and processing personnel are as follows: (9) degree competence needed score for the ability to safely apply and handle agricultural chemicals, (10) degree competence possessed score for the ability to safely apply and handle agricultural chemicals, (11) degree competence needed score for the ability to work cooperatively under adverse conditions, (12) degree competence possessed score for the ability to work cooperatively under adverse conditions, (13) degree competence needed score for the understanding of seed viability, purity, and germination, (14) degree competence possessed score for the understanding of seed viability, purity, and germination, (15) degree competence needed score for the understanding of crop maturity and planting dates, (16) degree competence possessed score for the understanding of crop maturity and planting dates, (17) degree competence needed score for the understanding of soil sampling, fertilizer recommendations and fertilizer selection, (18) degree competence possessed score for the understanding of soil sampling, fertilizer recommendations and fertilizer selection.

Correlations among control variables were significant at the one percent level in five comparisons and significant at the five percent level in two comparisons. The five correlations that were significant at the one percent level included four positive and one negative correlations. The four highly significant, positively correlated, comparisons were: years in seed business and years experience at present job (+.851), years in seed business and age (+.654), years experience at present job and age (+.600), kind of seed activities of the seed company and type of seed business (+.448). Age and the years of vocational agriculture completed were negatively correlated at the one percent level. The two variables that were significantly correlated at the five percent level were the number of years lived on a farm after age 12 to both age (+.251) and kind of seed activities of the seed company (+.219).

When control variables were correlated with degree of competence needed and possessed scores, three comparisons were significant at the one percent level and six were significant at the five percent level.

The three that were significant at the one percent level included two positive and one negative correlations. The two highly significant, positive correlations were between: (1) number of years in seed business and the ability needed to safely apply and handle agricultural chemicals (+.284); and (2) highest grade in school completed and the understanding possessed of soil sampling, fertilizer recommendations and fertilizer selection (+.320). The highly significant, negative correlation involved the variables, number of years lived on a farm after age 12 and the ability possessed to work cooperatively under adverse conditions.

Of the six correlations significant at the five percent level five were positive and one was negative. The highest grade in school completed was correlated at the five percent level with (1) the ability possessed to safely apply and handle agricultural chemicals (+.221); and (2) with understanding possessed of seed viability, purity, and germination (+.262). The number of years lived on a farm after age 12 was correlated at the five percent level with the ability possessed to safely apply and handle agricultural chemicals (+.245). The understanding possessed of crop maturity and planting dates was correlated at the five percent level with (1) the number of years in seed business (+.226), and (2) with the highest grade in school completed (+.220). The kind of seed activities of the seed company was negatively correlated at the five percent level with the understanding possessed of soil sampling, fertilizer recommendations and fertilizer selection (-.276).

When degree of competence needed scores were correlated with degree of competence possessed scores for the same competency the correlations were significant above the one percent level for all five competencies. The competencies with highest correlations between competence needed and competence possessed scores were the understanding of crop maturity and planting dates (+.634).

Correlations among degree of competence needed scores were significant at the one percent level in all but one comparison. The highest correlation was between the understanding needed of seed viability, purity, and germination and the understanding of crop maturity and planting dates (+.604).

Correlations among degree of competence possessed scores were significant at the one percent level for eight of the ten correlations and the other two correlations were significant at the five percent level. The highest correlation was between the understanding possessed of maturity and planting dates and the understanding possessed of soil sampling, fertilizer recommendations and fertilizer selection (+.710).

Conclusions drawn from the findings in this study by the author are varied. The most important is that the employees of the seed industry need more competence in seed production and distribution.

Some implications for educational programs may be drawn from these data:

1. The basic agricultural curriculum with emphasis on science and technology should be continued.
2. Leadership training, human relations, management, and salesmanship need to be given more emphasis in future educational programs.
3. Educational programs should be developed for employees of the seed industry to assist them in maintaining employment efficiency and for job advancement.
4. Educational programs organized in terms of the findings of this study should be broad enough in scope and specific in content to give students sufficient understanding and abilities for successful job entry and advancement in the seed production and distribution industry.

These 49 competencies should be useful in planning instructional programs related to seed production and distribution.

SUMMARY

This is one of a series of studies in Research Project 1733 conducted jointly by the Department of Agricultural Education and the Iowa Agriculture and Home Economic Experiment Station and the Agricultural Education Section of the Division of Vocational Education, State Department of Public Instruction.

The main objective of the study was to determine competencies needed by employees in the seed production and distribution. Secondary objectives were to determine (1) the degree of competence employees of the seed industry needed and possessed in the competencies and (2) relationships among the competencies and characteristics of the seed industry and employees of the seed industry.

A list of 49 competencies needed by employees in seed production and distribution was compiled by a panel of specialists in the seed production and seed distribution industry. The panel of specialists consisted of six members of the Iowa Crop Improvement Association and six members of the Iowa Seed Dealers Association with the secretaries of the two associations as consultants to the panel. Twenty-eight of the 49 competencies were abilities and 21 were understandings.

Questionnaires were mailed to 100 company managers with 80 usable questionnaires returned. Two hundred non-managerial employee questionnaires were mailed to persons employed in the four occupational areas of processing, production, sales, and service. A total of 120 usable questionnaires were returned from the first three occupational areas. The fourth occupational area of service was dropped from the study due to in-

sufficient returns.

Ratings were made on a five-point scale (0-4) with 0 indicating no competence and 4 indicating very much competence. All comparisons were made in terms of average mean scores from the 0 to 4 ratings of each of the 49 competencies.

All four employee groups, managerial, sales, production, and processing, indicated that all 49 competencies were needed. They also had higher overall competence needed scores than possessed scores.

The understanding of seed promotion (3.7), by sales personnel, was the competence with the highest score for competence needed among all abilities and understanding by employee groups.

The five competencies with the highest competence needed by managers and sales personnel were the abilities to: (1) make sound decisions unaided, (2) delegate responsibilities so employee can pursue work expected of him, (3) communicate effectively both orally and in writing, (4) use quality control measures to maintain quality of seed, and (5) work cooperatively under adverse conditions.

Of the five highest overall competence needed mean scores for individual abilities for both the managers and sales personnel, only one was related to an agricultural competency, whereas, the other four were related to management and business competencies. However, 29 of the total 39 competencies rated much competence needed are basic agricultural understandings and abilities. These competencies need most emphasis in educational programs.

The five competencies with the most competence needed by production and processing personnel were the abilities to: (1) safely apply and handle agricultural chemicals; (2) work cooperatively under adverse conditions; and the understandings of: (3) seed viability, purity, and germination; (4) crop maturity and planting dates; and (5) soil sampling, fertilizer recommendations and fertilizer selection.

Comparisons among seed production and distribution company employees classified by various characteristics resulted in the following groups having largest differences between overall mean scores for degree of competence needed and possessed: (1) employees in production, (2) production and processing personnel employed by a firm handling four or more kinds of seeds, (3) production and processing personnel with the least seed industry experience, (4) production and processing personnel with four years of vocational agriculture, (5) management and sales personnel with the least education, (6) the youngest production and processing personnel, (7) production and processing personnel who has lived on a farm for 31 years or more after the age 12.

A separate product moment correlation matrix was run for both the manager and sales personnel and, for the production and processing personnel. Eight control variables, five competence needed scores, and five competence possessed scores made a total of 18 variables in the matrix.

Seven correlations among control variables were found to be significant at the one percent level for managers and sales personnel. When correlations were made among control variables and competence needed scores, four were significant at the one percent level. The highest correlation was between the ability to communicate effectively both orally and in writing (+.344) and highest grade in school. Correlations between control factors and competence possessed scores resulted in four correlations significant at the one percent level.

All correlations, except one, were significant at the one percent level when correlations were made among the mean scores for competence needed and possessed in the five selected competencies. The highest correlation was between the ability to make sound decisions unaided and the ability to delegate responsibility so employee can pursue work expected of him (+.616).

Five significant correlations at the one percent level were found between the control items for production and processing personnel. When control variables were correlated with degree of competence needed and possessed scores, nine correlations were significant. One of these was highest grade in school completed and the understanding possessed of soil sampling, fertilizer recommendations and fertilizer selection (+.320).

The results of this study indicate all 49 competencies are needed for successful seed production and distribution. These competencies should provide the foundation for seed production and distribution instruction in high school vocational agriculture classes, area vocational-technical programs, in-service training programs in industry, and in land grant college programs.

BIBLIOGRAPHY

1. Abel, Francis L. Competencies in forage crop production and utilization needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1966.

2. Albracht, James J. A process for determining vocational competencies for the performance of nine essential activities for sales personnel in the feed industry, and the loci at which the competencies could be taught. East Lansing, Michigan, The College of Education, Michigan State University. June, 1966.

3. Beaver, Ronald D. Competencies in farm labor utilization needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1967.

4. Bennett, William C., Jr. Competencies in soil management and use of fertilizers needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1965.

5. Bundy, C. E. and Blake, D. L. Competencies in agriculture needed by males employed in off-farm agricultural occupations. Des Moines, Iowa, Co-operative Study-Department of Education, and Iowa Agriculture and Home Economics Experiment Station, Iowa State University of Science and Technology, Ames, and the Vocational Agriculture Section, State Department of Public Instruction. 1965. Original not available; cited in Taylor, Robert E. Summary of research findings in off-farm agricultural occupations. Pp. 46-47. Columbus, Ohio, The Center for Research and Leadership Development in Vocational and Technical Education, The Ohio State University. August, 1965.

6. Christensen, Maynard and Clark, Raymond M. Vocational competencies needed for employment in the agricultural-chemical industry in Michigan. Mimeographed paper. East Lansing, Michigan, College of Education, Michigan State University. 1966.

7. Christy, James R. Competencies in farm business analysis needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1966.

8. Clark, Raymond and Householder, William. Important areas of non-farm agricultural occupations. The Agricultural Education Magazine 37, No. 6: 169-170. January, 1965.

9. Clark, Raymond M. Vocational competencies needed for employment in the feed industry. Michigan State University Educational Research Series 22. 1965.

10. Hamilton, W. H. Competencies in agriculture needed by males employed in retail feed distribution. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1964.

11. Hoskey, Marvin R. Competencies in soybean production needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1969.

12. Johnson, Russell R. Competencies in corn production needed by farmers. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1969

13. Mabon, Elwood Jackson. Competencies in agriculture needed in country elevator grain marketing. Ames, Iowa, Iowa State University of Science and Technology. 1964.

14. Skinner, Robert. Resolutions adopted at the 64th Annual Convention. Unpublished xeroxed copy. Des Moines, Iowa, Iowa Seed Dealers Assoc. 1968.

15. Stevenson, William W. A study of employment opportunities and training needs in off-farm agricultural occupations in Oklahoma. State Board for Vocational Education and Oklahoma State University. 1965.

16. Taylor, Robert E. Summary of research findings in off-farm agricultural occupations. Columbus, Ohio, The Center for Research and Leadership Development in Vocational and Technical Education, The Ohio State University. August, 1965.

17. United States Department of Agriculture. Iowa Crop and Livestock Reporting Service, Annual Crop Summary-1968. 1969.

18. United States Department of Agriculture. Iowa Crop and Livestock Reporting Service, Corn Acreage and Production 1967 and 1968. 1969.

19. United States Department of Agriculture. Iowa Crop and Livestock Reporting Service, Field and Seed Crops-1968. 1969.

20. United States Department of Agriculture. Iowa Crop and Livestock Reporting Service, Seed Crops-1968. 1969.

21. Van Loh, F. A. Competencies in agriculture needed by males employed in retail fertilizer distribution. Unpublished M.S. thesis. Ames, Iowa, Library, Iowa State University of Science and Technology. 1964.

22. Wert, James E., Neidt, Charles O. and Ahman, J. Stanley. Statistical methods in education and psychological research. New York, N.Y., Appleton-Century-Crofts, Inc. 1954.

APPENDIX A

Code No. ______ For Employer Use

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Ames, Iowa 50010

DEPARTMENT OF EDUCATION

Dear Sir:

A few days ago you received a letter asking your cooperation in a study to identify the abilities and understandings needed by men employed in the seed industry.

Officers of the Iowa Crop Improvement Association and the Iowa Seed Dealers Association have been interested and very helpful in this study. This study is being conducted in cooperation with the Agricultural Experiment Station and Department of Education at Iowa State University and the State Department of Public Instruction. The results of the study may serve as the basis for future programs to train seed industry personnel in high schools and area vocational-technical schools.

Enclosed you will find questionnaire materials to be used by your company. This questionnaire is labeled "For Employer Use" and the others are labeled "For Selected Employee Use." From each of the occupational areas checked (X) below select one full-time employee whose major responsibilities are in that area to participate in rating the competencies.

( ) Processing--All that is involved in changing the harvested seed to the merchandised product.

( ) Production--All that is involved in planning, field management, and harvesting of the seed crop.

( ) Sales--All that is involved in seed promotion, merchandising the seed, advertising, and services identified with sales transactions.

( ) Service--All nonmanagerial maintenance, repair and unskilled labor.

Your frankness and critical analysis of each competency needed and possess by you and your selected employees are of utmost importance. The validity of th results of this study depends on these factors. Your evaluations will be kept i strict confidence and used for statistical purposes only.

A stamped, self-addressed envelope is enclosed for each reply. I thank yo for your cooperation on this study and for encouraging your employees to compl and return the enclosed questionnaire as promptly as possible.

Sincerely,

Charles K. Morrow
Research Assistant

CKM/sma

COMPETENCIES NEEDED BY SEED PRODUCTION AND DISTRIBUTION COMPANY EMPLOYEES

General Information

A. Name of Company ________________________ Town ________________

1. Average number of employees per month

January__________	May__________	September__________
February__________	June__________	October__________
March__________	July__________	November__________
April__________	August__________	December__________

2. Major activities (Check all that apply)

____Hybrid seed corn
____Soybean seeds
____Sorghum seed
____Small grain seed
____Grass and legume seed
____Vegetable and flower seed
____Grower
____Wholesales
____Retailer
____Mail order
____Packet seeds
____Other

3. Future needs for employees

Occupational area	Employed three years ago (1965)	Presently employed (1968)	Anticipated employment (1971)
Managerial			
Processing			
Production			
Sales			
Service			
Clerical			
Research			

B. Manager

1. Total years experience in seed business. __________years

2. Years experience at your present job. __________years

3. Years experience with present organization. __________years

4. Years lived on a farm after age 12. __________years

5. What is your present age? __________

6. Circle years of vocational agriculture in high school that you completed.
0 1 2 3 4

7. Circle the highest grade in school you completed.
Less than 8 8 9 10 11 12 College 1 2 3 4 more than 4

8. Months attended at technical, vocational, trade or commercial school.
__________ months

BE SURE TO COMPLETE ALL THREE PAGES
OF THE QUESTIONNAIRE

DIRECTIONS FOR COMPLETING QUESTIONNAIRE

1. In column A rate the degree of competence needed by you in each competency to be efficient in your employment situation.

2. In column B rate the degree of competence you possess in each competency.

3. Use the following scale when making analysis and rating on each competency:

0 -- No competence needed (or possessed)
1 -- Little competence needed (or possessed)
2 -- Some competence needed (or possessed)
3 -- Much competence needed (or possessed)
4 -- Very much competence needed (or possessed)

4. Place an "X" in the appropriate box in columns A and B to rate each understanding and ability.

5. Return to: Charles K. Morrow, 220 Curtiss Hall, Iowa State University, Ames, Iowa

Competency	A Degree of Competence Needed					B Degree of Competence Possessed				
	0	1	2	3	4	0	1	2	3	4
Ability to:										
0. Example--- identify farm seeds					X				X	
1. Identify common and noxious weed seeds										
2. Identify varieties of seeds										
3. Identify insects and diseases										
4. Recognize major plant nutrient deficiencies										
5. Safely apply and handle agricultural chemicals										
6. Collect moisture samples and harvest at correct time										
7. Prepare seedbed, plan planting rates and plant population										
8. Use quality control measures to maintain quality of seed										
9. Plan and schedule processing operations										
10. Properly operate cleaning and processing equipment										
11. Use and maintain scales, testing equipment and sampling devices										
12. Work cooperatively under adverse conditions										
13. Properly aerate and ventilate seed and storage area										
14. Utilize and explain a seed tag										

(Continued on back of this page)

	A					B				
	Degree of Competence Needed					Degree of Competence Possessed				
	0	1	2	3	4	0	1	2	3	4
15. Assist producers in seed, crop and demonstration plot problems										
16. Advise customers on seed selection										
17. Effectively present merchandise and sell directly to consumers										
18. Write legible sales slips and purchase orders										
19. Calibrate, repair and maintain production and processing equipment										
20. Keep an orderly tool and material room and office										
21. Be precise in observations and techniques										
22. Anticipate short and long range farming trends										
23. Effectively use credit ratings and procedures										
24. Make sound decisions unaided										
25. Delegate responsibilities so employee can pursue work expected of him										
26. Communicate effectively both orally and in writing										
27. Collect, analyze data and draw conclusions										
28. Plan routes for most economical transportation										
Understanding of:										
29. Plant propagation and reproduction										
30. Seed certification										
31. Genetic pedigree information										
32. Seed viability, purity, and germination										
33. State and Federal seed laws										
34. Governmental programs effect on seed sales										
35. Seed production cycles and trends										
36. Research projects, including sampling, controls, and acceptable analysis procedures										
37. Production contracts										
38. Cost of production per unit										
39. Potential variety production and market control										
40. Seed promotion										
41. Customer buying motivation										
42. Crop maturity and planting dates										
43. Soil sampling, fertilizer recommendations and fertilizer selection and use										
44. Soil conservation										
45. Chemical, biological and mechanical treatment of seed										
46. Seed movement and storage										
47. Seed drying procedures										
48. Limitations of stacking sacks and packages										
49. Service manuals for operating, repair and maintenance										

Please place completed questionnaire in the stamped, self-addressed envelope provided and drop it in the mail box today. Thanks.

APPENDIX B

Code No.______

For Employee Use

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Ames, Iowa 50010

DEPARTMENT OF EDUCATION

Dear Sir:

The Department of Education and Agricultural Experiment Station of Iowa State University and the State Department of Public Instruction are conducting a study of competencies needed by employees in the seed industry. The purpose of this study is to identify the important abilities and understandings needed by employees employed in the seed industry. This study may serve as the basis for future programs to train seed industry personnel in area vocational-technical schools. To accomplish this purpose I am contacting both selected employers and employees.

Because of the caliber of business and the knowledge he has demonstrated, your employer has been selected as a participant in the study. He has selected you as an employee to represent him in presenting opinions concerning these competencies.

Your frankness and critical analysis of each competency needed and possessed by you are of utmost importance. The validity of the results of this study depends on these factors. Your evaluations will be kept in strict confidence and used for statistical purposes only.

Will you kindly complete this questionnaire and return it as soon as possible. A stamped, self-addressed envelope is enclosed for your reply. I thank you for your cooperation on this study, and may I receive your completed questionnaire as promptly as possible.

Sincerely,

Charles K. Morrow
Research Assistant

CKM/sma

COMPETENCIES NEEDED BY SEED PRODUCTION AND DISTRIBUTION COMPANY EMPLOYEES

General Information

A. Name of Company ____ Town ____________

B. Employee

1. Total years experience in seed business. ____________ years

2. Years experience at your present job. ____________ years

3. Years experience with present organization. ____________ years

4. Years lived on a farm after age 12. ____________ years

5. What is your present age? ____________ years

6. Circle years of vocational agriculture that you completed in high school.
   0 1 2 3 4

7. Circle the highest grade you completed in school.
   Less than 8 8 9 10 11 12 College 1 2 3 4 more than 4

8. Months attended at technical, vocational, trade or commercial school.
   ____________ months

9. Briefly describe the nature of your work and the duties you perform:

____

____

____

____

____

____

**BE SURE TO COMPLETE ALL THREE PAGES
OF THE QUESTIONNAIRE**

DIRECTIONS FOR COMPLETING QUESTIONNAIRE

1. In column A rate the degree of competence needed by you in each competency to be efficient in your employment situation.
2. In column B rate the degree of competence you possess in each competency.
3. Use the following scale when making analysis and rating on each competency:

   0 -- No competence needed (or possessed)
   1 -- Little competence needed (or possessed)
   2 -- Some competence needed (or possessed)
   3 -- Much competence needed (or possessed)
   4 -- Very much competence needed (or possessed)

4. Place an "X" in the appropriate box in columns A and B to rate each understanding and ability.
5. Return to: Charles K. Morrow, 220 Curtiss Hall, Iowa State University, Ames, Iowa

Competency	A Degree of Competence Needed					B Degree of Competence Possessed				
	0	1	2	3	4	0	1	2	3	4
Ability to:										
0. Example--- identify farm seeds					X					X
1. Identify common and noxious weed seeds										
2. Identify varieties of seeds										
3. Identify insects and diseases										
4. Recognize major plant nutrient deficiencies										
5. Safely apply and handle agricultural chemicals										
6. Collect moisture samples and harvest at correct time										
7. Prepare seedbed, plan planting rates and plant population										
8. Use quality control measures to maintain quality of seed										
9. Plan and schedule processing operations										
10. Properly operate cleaning and processing equipment										
11. Use and maintain scales, testing equipment and sampling devices										
12. Work cooperatively under adverse conditions										
13. Properly aerate and ventilate seed and storage area										
14. Utilize and explain a seed tag										

(Continued on back of this page)

		A Degree of Competence Needed					B Degree of Competence Possessed				
		0	1	2	3	4	0	1	2	3	4
15.	Assist producers in seed, crop and demonstration plot problems										
16.	Advise customers on seed selection										
17.	Effectively present merchandise and sell directly to consumers										
18.	Write legible sales slips and purchase orders										
19.	Calibrate, repair and maintain production and processing equipment										
20.	Keep an orderly tool and material room and office										
21.	Be precise in observations and techniques										
22.	Anticipate short and long range farming trends										
23.	Effectively use credit ratings and procedures										
24.	Make sound decisions unaided										
25.	Delegate responsibilities so employee can pursue work expected of him										
26.	Communicate effectively both orally and in writing										
27.	Collect, analyze data and draw conclusions										
28.	Plan routes for most economical transportation										
Understanding of:											
29.	Plant propagation and reproduction										
30.	Seed certification										
31.	Genetic pedigree information										
32.	Seed viability, purity, and germination										
33.	State and Federal seed laws										
34.	Governmental programs effect on seed sales										
35.	Seed production cycles and trends										
36.	Research projects, including sampling, controls, and acceptable analysis procedures										
37.	Production contracts										
38.	Cost of production per unit										
39.	Potential variety production and market control										
40.	Seed promotion										
41.	Customer buying motivation										
42.	Crop maturity and planting dates										
43.	Soil sampling, fertilizer recommendations and fertilizer selection and use										
44.	Soil conservation										
45.	Chemical, biological and mechanical treatment of seed										
46.	Seed movement and storage										
47.	Seed drying procedures										
48.	Limitations of stacking sacks and packages										
49.	Service manuals for operating, repair and maintenance										

Please place completed questionnaire in the stamped, self-addressed envelope provided and drop it in the mail box today. Thanks.